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PSYCHIATRIC AND PHYSIOLOGIC STUDIES ON FATIGUE *

Preliminary Report

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and
GREGORY PINCUS, D.Sc.

BOSTON

This is a preliminary report of investigations which have been done on fatigue and related symptoms as found in psychoneurotic patients. The general plan of the research has been, first, to analyze the symptoms of fatigue from the point of view of the subjective reactions of the patient by means of data collected in psychiatric interviews; second, to investigate the nature of fatigue in regard to its physiologic and chemical concomitants. In addition to generalized fatigue, the phenomena associated with fatigue in localized muscle groups have been studied. The first results to be presented deal with the psychiatric aspects of the problem.

Psychiatric Studies

The term fatigue has so many different meanings that some definitions are in order. By derivation and as generally used here, fatigue means a feeling of tiredness, weariness or lassitude. This is in contrast with the physiologist's use of the word to mean a reduction in output of work, or the biochemist's meaning of changes in chemical constituents in the body associated with work. The particular group of patients in which we have been most interested have been those who complain of feeling tired over long periods of time when there is found to be no obvious exertion or medical illness to account for the feelings.

Symptoms. — At the present time we have collected data from 45 patients who complained of fatigue as one of their principal symptoms. Of these 45, there are 16 about whom we have considerable detailed information, having spent from twenty to sixty hours of interview time with each one. Our knowledge about the remaining 29 is primarily of a descriptive nature and usually has been obtained during one to three interviews.

In the entire group, it has been possible to make a satisfactory diagnosis in almost every case. As one sees these diagnoses tabulated, it is striking that about 80 per cent of patients complaining of fatigue had anxiety neurosis. The remaining patients were infrequently distributed among the other diagnostic groups (table 1).

In making out a questionnaire to obtain information from a great number of persons, we tabulated every separate statement made by patients concerning the way they felt when tired. When this was finished, we found

* From the Department of Medicine and the Department of Neurology and Psychiatry of the Harvard Medical School and the Department of Physical Medicine and the Department of Psychiatry of the Massachusetts General Hospital. This study was aided by a grant from the Baruch Committee on Physical Medicine.

* Read at the Twenty-Fourth Annual Session of the American Congress of Physical Medicine, New York, Sept. 5, 1946.

over 125 different ways of expressing their feelings when fatigued. The most striking thing about these complaints is the fact that such feelings may be referred to any organ, system or function of the body.

Thus, it appears, for instance, that these patients have difficulty in sleeping. This usually is found to mean that, although most patients think longingly of going to bed when they feel tired, upon getting to bed they find it difficult to go to sleep. In the morning it is characteristic for them to say they feel as tired as, or more tired than they did on going to bed. They frequently feel nauseated in the morning and may even vomit. Typically these patients feel worst in the morning and then become progressively better as the day wears on. Many feel best just before going to bed at night and may stay up till 2 or 3 a. m. for this reason.

A frequent complaint is that of difficulty in thinking clearly, inability to concentrate or a feeling of confusion. This may appear as a "cloudy feeling" in the head.

Somatic complaints are extremely numerous. Taking random ones from our list, we find blurring of vision, dizzy feelings, tightness in shoulders, back and chest, heaviness in various parts of the body, soreness here and there, nausea and so on (table 2).

Table 1. — *Psychiatric Diagnosis in 45 Fatigue Patients.*

	Percentage
Anxiety neurosis	78
Hysteria	2
Reactive depression	9
Psychosomatic disorders	7
Psychopathic personality	4

Table 2. — *Symptoms in 45 Fatigue Patients.*

	Per Cent
No ambition	55
Depression	55
Palpitation	51
Nervousness	51
Anorexia	49
Irritability	47
Headaches	47
Weakness	40
Confusion	40
Insomnia	33

Many are depressed in varying degrees. As a rule, those patients with relatively mild depressions complain most of fatigue and less of depressive symptoms. Several patients have described how they feel "helpless and hopeless"; other frequent adjectives are "blue," "defeated" and "inferior."

There is a considerable proportion of patients who say that when they feel tired they are irritable. The expressions used to describe this part of the symptom complex include "irritated" and "antagonistic." Among those with a military background, the complaint is apt to appear as "I get burned up" and as a result these patients sometimes "blow their top." The irritation may be suppressed; it may be expressed as "speaking with a sharp tongue" or it may even come out as violence. A few of the 10 veterans included in these 45 patients got into difficulty because of a propensity for getting into fights, especially when they had been drinking.

There are a number of statements used by patients to describe the difficulty in initiating activity. They have "no pep," "no ambition"; they want to put things off; everything "seems to be an effort" or "requires more energy" than before. Another group of complaints is closely related to those

which are familiar to every one following muscular activity. Some of these feelings are described as being "all in," "all gone," "worn out," "dragged out" or "faint." They feel "slowed up" and "drowsy." A similar but apparently distinct set of sensations center around weakness: these patients may feel "weak as a cat"; their knees "give way" or "turn to water"; their hands may feel "nerveless."

Questions as to the presence of anxiety symptoms elicit affirmative answers from most of our patients. They feel jumpy, jittery or nervous; they complain of sweating in the axillas and palms; they sigh and have feelings of not being able to take a full breath.

It was found that these feelings of fatigue were dependent on various situations. Rest relieves few of them, but a majority of the patients say that they feel better when doing interesting work. The movies help many; alcohol offers relief to some, particularly young men. Tobacco seems to be of help, but almost as many say it makes them feel worse. Sexual activities tend to increase the symptoms, especially in women who are frigid.

One of the most striking facts which has come to light in patients with chronic fatigue who have been intensively studied is that there are certain situations in which they suddenly feel extremely tired or weak. In some of these patients it has been possible to reproduce the feeling tone several times by discussing the same or similar incidents on different occasions. This type of investigation has led us to the conclusion that certain feeling tones are most often associated with the onset of fatigue symptoms. The two most frequent of these are feelings of being guilty of wrong-doing and feelings of being rejected or discounted by someone important to the patient.

The prominent situations leading to abrupt sensations of feeling tired have been tabulated from information obtained from 16 patients studied intensively. Since 2 patients showed two types of situation in which fatigue occurred, there are in all eighteen situations. These may be classified into "rejection" and "guilt" situations. In an attempt to class these roughly, we find that in the "guilt" group (table 3) there are three instances of guilt

TABLE 3. — *Guilt Situations Precipitating Fatigue Episodes.*

1. Masturbation; sex play with older woman	5. Aggression toward mother
2. Memory of sex play with old man as child	6. Feeling of contributing to mother's illness
3. Masturbation	7. Husband's mistress commits suicide
4. Unkindness to murdered sister	8. Hostility toward husband and child
	9. Hostility toward husband and child

over sexual practices considered to be reprehensible by the patient; three instances in which the patient felt responsible for some injury to a member of her own family, and three related to marital difficulties.

In the "rejection" group, the situation is simpler (table 4); 4 of these patients had distress in connection with real or possible future rejection by a spouse; 5 had fatigue following real or fancied rejection by some one in a position of authority relative to them.

TABLE 4. — *Rejection Situations Precipitating Fatigue Episodes.*

1. Husband philandering	6. Hard work discarded by boss
2. Husband philandering	7. Misunderstanding with doctor
3. Possibility of financee's leaving him	8. Reprimand by boss
4. Deserted by wife	9. Turned down for job "politics"
5. "Kicked upstairs" from responsible job	

The most striking findings have been: (1) the extreme variability in the patient's feelings from day to day and hour to hour; (2) the onset of symptoms in connection with specific situations. This is illustrated in the

following summary of the case of a patient diagnosed with anxiety neurosis. This patient found relief from an unpleasant home situation in the psychiatric ward. His symptoms vanished, and he boasted of his energy. Then, following misunderstanding a statement made by his doctor which he took to mean that the doctor, too, had deserted him, he felt "burned up," couldn't sleep, arose the next morning feeling very tired and too nauseated to eat breakfast. Later in the day, when the situation was cleared up to his satisfaction, he at once felt much better, "in the pink," and jumped out of bed the next morning feeling greatly refreshed by a good night's sleep.

Physiologic and Chemical Studies

General Fatigue. — In these same patients we have done physiologic and biochemical studies during exercise tests. The first group of experiments were concerned with muscular work involving a great many muscles of the body, using a bicycle ergometer. The exercise situation was one which was designed not to carry the patient to exhaustion. A standard braking resistance was used in all tests, and the duration was constant at three minutes. The number of revolutions per minute was registered and for males was 37 r. p. m. and for females 30 r. p. m., as this was found in both instances to lead to subexhaustive work.

Blood samples were taken for determination of (1) lactic acid, (2) pyruvic acid, (3) cholinesterase and (4) glucose, before the test, immediately at completion and at three and fifteen minute intervals later. Heart rate and ventilation were recorded throughout the experiments, as well as the electroencephalogram.

Results: In both male and female patients blood lactate immediately at the end of exercise increased to a level consistently higher than that of the control group, as seen in chart 1. Another point of difference which

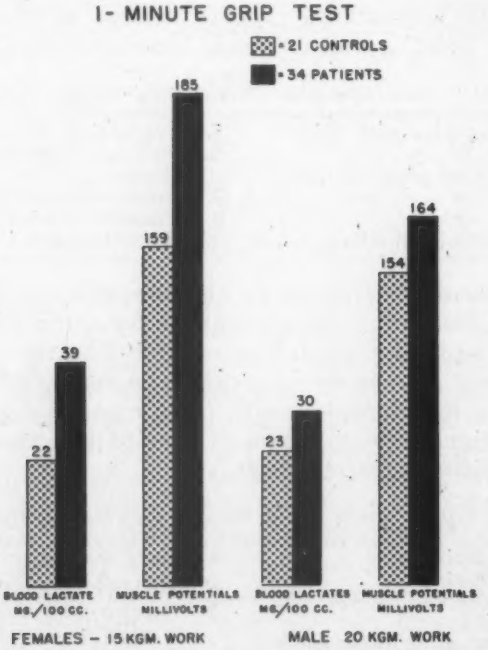

Chart 1. — Effect on blood lactic acid of subexhaustive bicycle ergometer test.

was even more striking between the patients and controls was the maintenance of a high lactate level fifteen minutes after exercise.

Blood pyruvate levels also showed greater increase after exercise in the patient group, particularly fifteen minutes after exercise. The mean blood pyruvate increase and the per cent increase have been tabulated in table 5.

TABLE 5. — *Three Minute Bicycle Test — Blood Pyruvate.*

Patients				Controls			
Number	Before Test, Mg. 100 cc.	Increase After 15 Min., Mg. 100 cc.	Per Cent	Number	Before Test, Mg. 100 cc.	Increase After 15 Min., Mg. 100 cc.	Per Cent
24 M.	0.45	0.51	113	15 M.	0.47	0.31	66
9 F.	0.45	0.27	60	10 F.	0.66	0.02	3
33	0.45	0.39	87	25	0.55	0.17	30

Blood cholinesterase levels were determined before exercise, immediately after and three and fifteen minutes later. As expected, no significant variation was found in the first 4 patients and 1 control; hence these measurements were abandoned in the later cases.

The mean increase in heart rate at the end of exercise was 41 per minute in the 14 male and 4 female patients. In 11 female controls the increase was only 28.

A correlation of 0.6 was found when the increase in heart rate immediately after exercise was plotted against the increase in lactice acid fifteen minutes after exercise. This correlation suggests that the factors associated with physical fitness play a role in our results.

Ventilation was measured in 25 controls and 28 patients. Preliminary values were higher in both male and female patients than in the controls, the mean value in liters per minute 4.95 for the controls and 6.8 for the patients. Increase with exercise was essentially the same in the two groups.

The electroencephalogram was recorded for two minutes before the bicycle test and for two minutes immediately after the end of pedaling, in an attempt to discover whether any change took place as a result of this degree of exertion. The records were analyzed for the distribution of the component frequencies in order to determine whether a change in any frequency band had taken place. No change as a result of exercise was found either in the control series or in the patients. It is concluded that this degree of exertion for this period of time has no effect on the electroencephalogram.

These results of these measurements suggest that there is some physiologic variant in this group of patients as compared with the controls. This is shown most clearly by the blood lactate and heart rate increase after exercise. We are not as yet in a position to conclude whether this can be ascribed to the psychiatric state or to the condition of physical fitness.

Local Fatigue. — In order to study the effects of exercise upon a smaller number of muscles limited to a single extremity, a grip test was designed. This consisted in having the subject squeeze a metal-handled spring dynamometer at a constant degree of tension for a period of one minute. All subjects were able to complete the tests, as effort of this duration did not produce exhaustion. We found it necessary, however, to regulate the tension at 15 Kg. for the female and 20 Kg. for the male subjects. During this experiment action potentials were recorded by surface electrodes from the flexor muscles of the forearm on an ink-writing oscillograph equipped with an integrating instrument such that the total voltage discharge was registered.

Results: In both patients and controls a considerable increase in blood lactate was observed from samples taken immediately at the end of the test and three minutes later, the degree of increase being greater in the patient group. Males and females were separated in tabulating, as the dynamometer tension was different. We also observed that the mean voltage of the action

potentials was consistently greater in the patient group in both sexes. The relationship between blood lactate level at the end of the test and voltage of action potentials has been diagrammatically shown in chart 2. It can be seen that the patient group apparently were less efficient in this test, as they

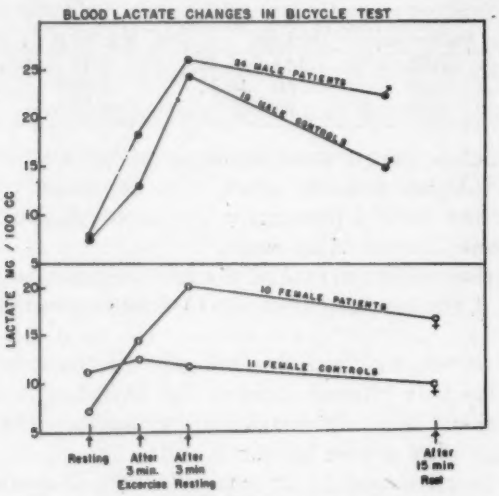

Chart 2. — Gripping dynamometer for one minute at tension of 15 Kg. for females and 20 Kg. for males. The mean resting blood lactate values in all groups were 9 mg. per hundred cubic centimeters. Resting muscle potentials were zero.

discharged more electrical activity and produced more lactate while doing the same amount of work as the control group.

The blood pyruvate levels were determined in the same blood samples and were found to follow the same pattern as the lactate results, there being a somewhat higher level in the patients at the end of the test than in the controls.

The cholinesterase levels were measured in terms of millimols of carbon dioxide liberated per hour per liter of serum. There was no difference related to either sex, control, or patient groups.

Ulnar Nerve Stimulation. — In order to further investigate fatigue produced locally and particularly to explore the possibility of fatigue of the neuromyal junction or transmission fatigue, other experiments were set up. The ulnar nerve was stimulated electrically at the elbow by a surface electrode held in place at as nearly constant tension as possible with a spring balance electrode or by an elastic bandage. Mechanical recordings of the contraction of the wrist and fourth and fifth fingers were obtained on a kymograph. The stimulating current was that of unidirectional, square wave impulses of 0.05 millisecond duration with a frequency of 500 per second and a voltage of 49. The skin resistance was measured and always reduced to less than 5000 ohms by the use of electrode paste. This strength of current found to be that which was nearly maximal as far as sensation was concerned, but it was not always supramaximal in relation to the muscular contraction. The current was applied for a period of four minutes. Blood samples were taken from the antecubital vein immediately before the test and at the end of stimulation.

Results: The blood lactate level was observed to rise over 100 per cent immediately following stimulation (table 6).

TABLE 6. — *Ulnar Nerve Stimulation, Four Minutes.*

Number	Blood Lactate — Mg./100 cc. Before Test	Increase
10 patients	11.1	13.05 = 116%
11 controls	9.5	9.8 = 103%

49 volts — 0.05 msec. square waves — 500/second.

This increase in lactate was observed in both patient and control subjects and is of interest in view of the statements commonly found in physical therapy texts to the effect that electrical stimulation of muscles is not followed by increase in lactic acid.

Corresponding increase was noted in the blood pyruvate levels after stimulation in all subjects.

Blood cholinesterase was measured before and after stimulation but no significant changes were observed. The mean resting values ranged between 86 and 121 millimols of carbon dioxide liberated per hour per liter of serum. At the end of stimulation the values varied between 89 and 122 millimols.

These results have given no indication of a defect of neuromuscular transmission as far as chemical studies are concerned. In some subjects muscles gradually relaxed, although the stimulation was continued, but because of certain technical difficulties in stimulation we could not be convinced that this was true transmission fatigue.

Endocrinologic Studies

An attempt was made to study the role of adrenalcortex secretion in patients with fatigue. It has been shown that an adrenal cortical hormone, presumably 11-oxygenated corticosteroid, regulates the production of circulatory lymphocytes.[1] In a series of 21 patients diurnal rhythms were established for a period of three days by counting the absolute number of circulating lymphocytes at specific periods during the day. On subsequent days the patients and controls were subjected to stress situations lasting for a period of one hour between 2 and 3 p. m., when normally a slight rise is expected. The stress situations consisted in exposure to cold for a period of one hour, inhalation of low oxygen mixtures, performance on a pursuit meter and a stress interview during which topics disturbing to the patient were discussed.

The diurnal rhythms showed the morning decrease and afternoon rise, which have been previously described,[2] but several of the patients had unusually low absolute counts. About half the patients showed a marked drop in lymphocyte count immediately after the various stress situations. Others showed a delayed response in that the decrease in lymphocytes did not occur until about one hour later. In about one-third of the patients there was no change or a slight rise in lymphocytes.

These results suggest that most of the patients in this group react to the stress situation by an increased production of 11-oxygenated corticosteroid, which in turn decreases the circulating lymphocytes.[3]

The breakdown of circulating lymphocytes resulted in an increase in excretion of uric acid in the urine without change in the blood level.

1. Dougherty, T. F., and White, A.: Influence of Hormones on Lymphoid Tissue Structure and Function: The Role of the Pituitary Adrenotropic Hormone in the Regulation of the Lymphocytes and Other Cellular Elements of the Blood, Endocrinology 35:1, 1944.
2. Elmadjian, Fred, and Pincus, Gregory: A Study of the Diurnal Variations in Circulating Lymphocytes in Normal and Psychotic Subjects, P. Clin. Endocrinol. 6:287 (April) 1946.
3. Hoagland, Hudson; Elmadjian, Fred, and Pincus, Gregory: Stressful Psychomotor Performance and Adrenal Cortical Function as Indicated by the Lymphocyte Response, J. Clin. Endocrinol. 6:301 (April) 1946.

Summary

A series of psychiatric, chemical and physiologic studies were done on 45 psychoneurotic patients complaining of fatigue and on a comparable control group.

The clinical material indicated a great variability in the symptoms, but 80 per cent of the patients were given diagnosis of anxiety neurosis.

In 16 of these patients studied intensively, specific situations associated with feeling tones of guilt and rejection preceded the onset of fatigue episodes.

The blood lactate and pyruvic acid showed a significant increase following an exercise test on a bicycle ergometer, which rise was considerably greater in the patients and was maintained for a longer period of time.

There was a correlation of 0.6 between the blood lactate and the heart rate increase after exercise.

A grip test for local fatigue showed a greater increase in action potentials and lactic acid production in the patients.

Blood lactice acid level increased 100 per cent following four minute stimulation of the ulnar nerve with a tetanizing current.

Most of the patients showed a decrease in circulating lmphocytes resulting from a variety of stress situations of one hour's duration, which is ascribed to increased adrenal cortex activity.

THE ROLE OF THE PHYSIOLOGIST IN PHYSICAL MEDICINE *

W. A. SELLE, Ph.D.

GALVESTON, TEXAS

The role of the physiologist in certain aspects of the broad field of physical medicine is obvious to all physiatrists. Nevertheless, I, a physiologist, often find myself wondering what I and my fellow workers throughout the country might do to assist more in the further development of this branch of medicine. Many other physiologists share my interest and concern in this rapidly expanding field.

Physiologic Basis of Physical Medicine

Physiology is a science in its own right, and the worker who pursues interests detached from medical problems need not offer an apology for his academic outlook. Some of the most significant contributions to medicine, in fact, have been the outcome of laboratory studies whose applications could not have been foreseen. This is true, of course, in other fields, the electron tube being one of many notable examples in the field of physics. Nevertheless, most persons will agree that the medical physiologist should emphasize those aspects of the subject which throw light upon disturbances of function and upon the diagnosis and treatment of disease. He can in this way play a part in giving the student and the practitioner a vantage point from which they may gain a rational view for the practice of medicine.

* From the Medical Branch, University of Texas.

* Read at the Twenty-Fourth Annual Session, American Congress of Physical Medicine, New York, Sept. 4, 1946.

While physiology is the basis for the practice of all medical specialties, it is particularly so for physical medicine. That physiologists are interested and participate actively in the development of this phase of medicine is indicated by the fact that four of the nine members of the Scientific Advisory Committee of the Baruch Committee on Physical Medicine have distinguished themselves in the physiologic sciences. These are John F. Fulton, professor of physiology at Yale University; Andrew C. Ivy, recently professor of physiology at Northwestern University and now dean of the medical school and vice-president of the University of Illinois; Francis O. Schmitt, head of the department of biology of Massachusetts Institute of Technology, and Chauncey D. Leake, dean of the medical school and vice-president of the University of Texas.

The Physiologist and Instruction in Physical Medicine

It is generally agreed that one of the greatest needs for the further development of physical medicine is improved undergraduate medical instruction in this field. Several years ago, Alan Gregg, Medical Director of the Rockefeller Foundation, described the existing situation in the schools as follows[1]: "A curious phenomenon in American medicine is the deft elimination of much reference to physical therapy, almost as those who keep their children ignorant of the facts of life, we appear to protect the American medical student from the knowledge of physical therapy. . . . The current unabashed ignorance of physical therapy in this country leaves it as an excellent opportunity for development in American medicine." It is, indeed, regrettable that instruction in this phase of medicine in most schools has been neglected, if not completely ignored. The situation, however, is being corrected. In this the physiologist is lending a hand.

In arranging a teaching program in physical medicine for undergraduates, it is felt by many that a proper perspective should be maintained, for it is admitted that this developing specialty does not yet rest upon as well recognized a foundation as such branches as pharmacology or radiology. The Baruch Committee[1] itself recommends that only the minimal fundamental facts regarding the scientific basis and the clinical application of physical agents be presented in the curriculum of the undergraduate medical school. Dr. Piersol,[2] too, has expressed the opinion that until such a time as the knowledge of physical medicine is more crystallized it seems premature to overemphasize the subject in undergraduate courses. In accordance with these prevailing views, it appears appropriate to stress to undergraduates the fundamental physiologic and physical principles underlying physical medicine; to point out to them what therapeutic results may reasonably be expected from physical methods, carefully avoiding exaggerating claims and unproved dogmatic statements.

In this regard, another comment by Dr. Gregg, made in 1940, is appropriate.[3]: "The effects of heat on capillary circulation, lymph flow and inflammation, and the indications and effects of massage and passive movement or of irradiation, can certainly be learned and taught as physiology without any trace of charlatanry."

Bouman and Coulter[4] also have pointed out that since physical medicine has its roots in physiology, the fundamentals underlying clinical physical medicine should be demonstrated during the course in physiology. At Northwestern University an unusual degree of cooperation between the depart-

1. Annual Report of the Baruch Committee on Physical Medicine, April 1, 1944, to March 31, 1945, New York.
2. Piersol, G. M.: Physical Medicine Came to Its Own, Arch. Phys. Therap. 25:721, 1944.
3. Gregg, A.: Addenda to the Agenda for the Decade 1940-1950, J. A. M. A. 114:1139, 1940.
4. Bouman, H. D., and Coulter, J. S.: The Teaching of Physical Medicine in a Medical School, Quart. Bull. Northwestern Univ. M. School, 19:314, 1945.

ments of physiology and physical medicine has existed for some years. There the physiologists stress at the appropriate place in their course the practical application of any physical or physiologic principle which bears on diagnosis or treatment by physical means. Members of the department of physical medicine give a number of lectures in the department of physiology. Heating of tissue by paraffin and whirlpool baths, thermogenic (infra-red) radiation and diathermy is demonstrated. The effect of direct current and muscle stimulation, ultraviolet rays and surgical diathermy on tissue is discussed and demonstrated. Later, in the junior year, the clinical aspects of physical medicine are presented.

In order to introduce the importance and sound physiologic background upon which some of the forms of physical treatment are based, a special course, Medical Physics, has been created at the University of Texas; it is given chiefly by members of the department of physiology but is not incorporated in the regular work of that department. An opportunity is here afforded to indicate the vast and unexplored potentialities of physical medicine.

The Physiologist and Biophysics

In the past, medicine has perhaps been aided more by chemistry than by physics. During recent years, however, there has been a tremendous surge forward in the development of electrical and mechanical devices employed in medicine. But instruction in the application of physics to medicine has failed to keep pace with the seven-league strides of the physicists; in fact, biophysics, as part of the medical school curriculum, has not yet developed to the romper stage. In this connection one further statement by Dr. Gregg, recently quoted by Dr. Krusen,[5] is pertinent: "Among my major hopes, let me record the wish that biophysics may be soon recognized as the brother of biochemistry, even if it is too late to consider it a twin. . . . One of the natural outgrowths of such a preclinical science might be the long overdue growth of physical therapy in this country."

I have recently had the opportunity of contacting educators and administrators of more than twenty leading medical schools and research institutions in this country and Canada. It was the unanimous opinion of this group that the application of physics to medicine be stressed more in the undergraduate medical schools and that definite steps for improving such instruction be taken as soon as possible. The manner in which such improvement is eventually made will obviously vary somewhat in different institutions.

Biophysics in most medical schools at present is largely under the mandate of the physiologist. It is true that some schools possess a separate department of biophysics, but as such it is used mainly for research. Until that time when teaching departments in this subject are established, the physiologist primarily must be responsible for creating a better understanding of the application of physics to medicine. At the University of Texas, the department of physiology accepted the responsibility for improving instruction in this subject and created the course referred to previously. This course was presented according to several key principles. The first of these was the familiar principle of physics in the study of normal physiology. The second was the role of physics in the diagnosis of certain diseases, the physical aspects of which are often employed in the study of normal physiology. The third considered the importance of physics in treatment of disease by physical methods.

5. Krusen, F. H.: The Future of Physical Medicine, M. Ann. District of Columbia 14:239, 1945.

Subsequent to assignments reviewing certain elementary and basic considerations, the applications were presented by members of the faculty best qualified to give such instruction. Some of the subjects included were: mechanical principles in body movements and in orthopedics, hydraulics of the body fluids (in normal physiology and in circulatory diseases) and hydraulics in relation to orthopedics; heat (in relation to control of body temperature and to diathermy); sound (in relation to the human ear, to physical diagnosis and, of course, to deafness); optics (in relation to vision and to special instruments; electricity (in relation to electrocardiography and electroencephalography, in diathermy and in other diagnostic and therapeutic instruments). The course also included instruction in the physical and physiologic effects of ultraviolet and of infra-red radiation and thus laid the foundation for further work in physical therapy during the clinical years.

Offered in the form of twenty-one lecture demonstrations, the course is believed to be a pioneer in relation to current interest in physical medicine as supported by the Baruch Committee. The course was completed with such gratifying results that both the administration and I are convinced that the step was in the right direction. Moreover, the real proof of the pudding lay in the response of the students to such instruction. This was uniformly good, if not enthusiastic. In fact, the students themselves suggested that such work be regularly offered. In consequence, a division of medical physics has been created within the department of physiology, and the course is being repeated this fall with only minor alterations. Looking to the further development of this subject, the administration has recommended to the board of regents of the university that such instruction be part of the medical curriculum from now on and that a department of biophysics be established this next biennium.

The role of the physiologist in assisting in the training of physical therapy technicians, interns and residents is too well known to require comment here.

The Physiologist and Efforts to Improve Premedical Physics

There is still another way in which the physiologist can assist in the further development of physical medicine. It is generally recognized that premedical physics is universally poorly taught and poorly received. In contrast to chemistry or biology, premedical students frequently see little in physics which has any immediate bearing on their medical studies or more remotely on their medical practice. It is natural, then, that generally they grudge the time that must be spent on it in order to make certain passing grades. This unfortunate attitude toward physics is often strengthened by the experience of those who have preceded them to the medical schools — that the physics needed in the study of medicine is not quite the physics they received. In this, there is often much truth. Most courses in physics are designed more for the engineer than for the medical man, who, in the opinion of many, needs a course with shifted emphasis of subject matter.

Too often the premedical instructors in physics are not interested in the application of physics to medical science. Steeped in the traditional and mathematical aspects of the subject, many instructors seem to be unaware of the vast potentialities of their subject in medicine. Why should the professor of physics discuss in great detail the stresses and strains of a bridge or skyscraper but show little interest in the mechanics of the human frame? Likewise, it is just as important to the student of medicine to know that transformers are used in medicine as to know they are found in the great industries or on poles behind his house.

Whatever the reason for the adverse attitude toward physics by the premedical student, it is obvious that he, and too often the instructor, does not accord to the subject the recognition to which its potential value in medicine would entitle it. As was aptly stated by Professor Harrington: "The student views physics as an essential subject only in a technical sense, as merely a hurdle that must be cleared somehow before he can get down to things that matter."

This rather severe indictment of the teaching of premedical physics in colleges throughout the country is not new. Certainly it has been the opinion of most physiologists for many years that the majority of students entering medical school have a training in physics which is inadequate for their proper comprehension of the material presented in physiology. Recognition of such deficiency by the Baruch Committee is indicated by its recommendation that better teaching of this premedical subject be promoted. The physiologist, wondering why physics teachers seemingly stress and describe in great detail the flow of liquids in rigid pipes but apparently show little interest in the flow in tubes having elastic walls, has already assisted materially in improving the character of such premedical instruction. Specific recommendations regarding course content and hours must still be sent to many college administrators and physics departments. In general, however, through the combined efforts of those concerned results during the past few years have been reassuring.

The Physiologist and Postgraduate Instruction

Recently and through efforts of members of the department of physiology of the Medical Branch, University of Texas, which does not yet have a separate and fully developed section on physical medicine, a session of postgraduate instruction in physical medicine for practitioners and technicians was planned and carried out with gratifying success. The total number of registrants for the session was well over one hundred. The roster of invited lecturers included Drs. Frank Krusen, Richard Kovács, Robert L. Bennett, Howard A. Rusk, A. B. C. Knudsen, Robert F. Dow, Arthur M. Pruce and certain members of the school staff.

Commenting on the efforts for this occasion, the ARCHIVES OF PHYSICAL MEDICINE stated: "The interest aroused in the medical profession and in the public press by this so far unique and timely course of instruction bids well for the future progress of physical medicine in Texas and the Southwest."

While it is readily admitted that the success of this course was due to the cooperation and excellence of the visiting men, it demonstrates that worth while programs in physical medicine can be carried out in schools not yet possessing a well established department in this field.

Incidentally, this course was particularly valuable to members of our own faculty, many of whom were entirely unfamiliar with even the most fundamental matters concerning the use of physical methods in treating disease. It did much toward overcoming some of the well known apathy and outright opposition to physical medicine, so often encountered in even the best institutions.

The Physiologist and Research in Physical Medicine

Physiatrists do not have to be told that the further development of physical medicine rests heavily on research—both basic and clinical. Until recently little fundamental investigation in this field had been undertaken. Most of the conclusions concerning the value of physical methods for treat-

ing diseases were based chiefly on uncontrolled observations on patients. It is well agreed that no matter how carefully clinical investigations are conducted, erroneous conclusions may be reached unless such studies are supported by adequate laboratory work. As other writers have repeatedly pointed out, the lack of basic research has militated against the proper development and understanding of physical medicine.[6]

While certain fundamental problems in physical medicine can be approached best through experimentation on laboratory animals, many can be elucidated only by observations upon man. The normal human subject as the guinea pig possesses unique advantages for many types of investigation, particularly in physical medicine. Furthermore, nature produces abnormalities of structure and function which the physiologic laboratory cannot imitate or can imitate only in the crudest way, arthritis being one of many examples. In the last analysis, therefore, the human subject becomes the animal of choice. The clinical physiologist, fully realizing the advantages and opportunities afforded by the hospital wards, has already made significant contributions to knowledge concerning the effects of physical agents. One need only to scan the titles of the papers being presented at physical medicine meetings the country over to witness the scope of the fundamental physiologic studies taking the attention of present day physiatrists.

Coordinated, Cooperative Research

As in other fields of medicine today, few important contributions to any knowledge can be expected except by those who will systematically work as members of organized groups. The sphere of knowledge has increased to such an extent that no one person can become highly skilled in more than one or two subdivisions of any medical field. The lone worker, therefore, is being replaced by a carefully chosen corps whose various talents dovetail together and whose collective knowledge and collective analytic powers greatly exceed those of a single individual. This widening of the horizon requires added expenditure of time and effort, but it pays dividends.

The Baruch Report[7] has, accordingly, suggested that the most economical and effective method of pursuing adequate research in physical medicine is through organization of a team headed by a specialist in this field, and appropriately trained, interested laboratory assistants. Piersol,[8] too, has stated that effective research in physical medicine cannot be conducted by any single individual and that ultimate success will depend on the effectiveness of a coordinated effort among clinicians, trained technicians and investigators in the field of basic medical sciences. Hence, cooperative research in physical medicine is a necessity, as it is in any other field of activity in which progress is to be achieved.

The medical physiologist, with his broad "know how" of approaches and technics, together with his training in specialized fields, should be particularly well qualified to assist group efforts of the type needed in physical medicine. It is with much gratification, indeed, that one finds teams including physiologists in such institutions as Northwestern, Minnesota, The Mayo Clinic, Harvard, Columbia, Pennsylvania, Iowa and others. These groups have learned the importance of cooperative research and realize that in order to hasten the day when better methods in physical medicine are available it is necessary to cease trifling and bring to bear some of the energy and re-

6. Karsner, H. T., and Goldblatt, H.: Evaluation of Methods Used in Physical Therapy, in Handbook of Physical Medicine, Chicago, American Medical Association, 1945.
7. Report of the Baruch Committee on Physical Medicine, April, 1944, New York.
8. Piersol, G. M.: Functions of Center for Instruction and Research in Physical Medicine, Arch. Phys. Med. 26:133, 1945.

sources, the determination and concerted effort which proved so effective in the recent war problems.

Summary and Conclusions

Recapitulating, the physiologist can contribute to the further development of this field of medicine by: (1) indicating early in the training of the medical student, through regular or special courses in physiology, the value of physical methods in diagnosis and treatment; (2) giving instruction in biophysics which, in most medical schools at present, is largely under the mandate of the physiologist; (3) insisting that premedical instruction in physics be improved; (4) assisting in the training of physical therapy technicians, interns and residents; (5) assisting in postgraduate and refresher courses in physical medicine; (6) conducting basic and clinical research in this field.

In closing this paper, I find myself wishing that I were an orator rather than a rambling and uninteresting physiologist, for surely there is opportunity for all to profit from the events of the day and from the recommendations of such groups as the Baruch Committee.

We physiologists and other medical teachers and investigators are challenged to look upward to the future of this new field with its unlimited boundaries. If Horace Greely were here today he would probably say: "Go physical medicine, young man, go up and grow up in space. There lies the unfathomed West of Medicine, with no last frontiers; there lies a vast wilderness rich in resources, opportunities and adventure. The Forty-Niners of the present decade will be the prospectors in physical medicine."

The day of pioneering in physical medicine is thus far from ended; it has, in fact, scarcely begun. But trail blazing now calls for joint effort of groups. The combined resources, experience and vision of teachers and investigators in this field must fuse harmoniously to achieve further success. Happily, indeed, there are now numerous indications that organized, coordinated instruction and research in physical medicine, so long overdue, are beginning to mark and cut a path—a path which cannot be mistaken.

RELIABILITY OF A SINGLE EFFORT MUSCLE TEST *

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The first attempt to evaluate human muscle strength was made by De la Hire about 1699.[1] Just prior to 1807 Regnier[2] developed an instrument for measuring strength which was the forerunner of the "grip," or hand, dynamometer familiar to modern anthropologists. The present day instrument, "a steel ellipse, of definite dimensions and elastic strength, with a scale and an indicator within its orbit" [3] measures the strength of shortening and isometric tension of a muscle resulting from the exertion of maximal volitional effort. A recent study, undertaken at the Baruch Center, using a hand dynamometer and other strength-testing devices, raised the question of the reliability and the validity of the dynamometer as tool for measuring muscle strength.[4]

The object of this study was to determine the reliability of a single effort muscle test as measured by the hand dynamometer and to determine the optimum number of trials for clinical testing.

Procedure

The Data. — An investigation already under way by Fischer[5] provided a large body of data amenable to the statistical study of one aspect of the technic of testing muscle strength. The subjects of Fischer's study were eleven females and two males varying in age from nineteen to forty-nine years, engaged in reasonably active professions. Each subject performed the grip test, using a standard hand dynamometer, with the right and with the left hand, ten times daily, Monday through Saturday, for a period of time extending from twenty-three days (subject 8) to eight months and twenty-six days (subject 1). Layoff periods ranging from three to one hundred fourteen days occurred for all except subjects 1 and 8. No effort was made to control the general body position of the subject during the test, which was executed by holding the dynamometer in the hand and gripping it with maximal pressure; the score was recorded in kilograms and the needle returned to 0 before the next trial. The instrument used did not lend itself to accurate reading in smaller units. The raw scores thus obtained were subjected to statistical analysis. The material studied is summarized in table 1.

Statistical Analysis. — Averages of the ten daily trials were calculated, and from these the range, mean, standard deviation, standard error and coefficient of variation for the left and right hands of each subject and of the group were computed. In order to establish reliability of the instrument and of the test, coefficients of reliability were obtained by applying the Pearson product-moment method of self correlation to the following sets of data:

1. One hundred samplings taken of the first and second trials from the initial ten days of 10 subjects.
2. One hundred and twenty samplings taken of the first and second trials from every tenth day of all subjects.

* From the Baruch Center of Physical Medicine, Division of Clinical Research, Medical College of Virginia.

* Read at the Twenty-Fourth Annual Session, American Congress of Physical Medicine, New York, Sept. 5, 1946.

1. Bullard, William N.: Reference Handbook of the Medical Sciences, New York, William Wood & Company, 1886, p. 545.
2. Dawson, Percy M.: The Physiology of Physical Education, Baltimore, Williams & Wilkins Company, 1935, p. 737.
3. Hrdlicka, Ales: Practical Anthropology, Philadelphia, Wistar Institute of Anatomy and Biology, 1939, p. 32.
4. Hellebrandt, F. A.; Parrish, Annie M., and Houtz, Sara Jane: Cross Education: The Influence of Unilateral Exercise on the Contralateral Limb, Arch. Phys. Med. 2:76, 1947.
5. Fischer, Ernst: Muscle Strength and the Weather, Arch. Phys. Med., to be published.

Table 1. — *Material Studied.*

Case No.	Sex	Age	Duration of Observation		Test Days, No.	Trials, Total No.
			Months	Days		
1	M	49	8	26	207	4,140
2	F	24	8	23	204	4,080
3	F	35	8	1	64	1,280
4	F	19	3	23	68	1,360
5	F	45	8	23	122	2,440
6	F	33	8	0	104	2,080
7	F	29	7	24	73	1,460
8	F	23	0	27	23	460
9	F	37	4	28	52	1,040
10	F	25	5	7	54	1,080
11	F	31	4	6	92	1,840
12	F	27	4	3	67	1,340
13	M	35	2	22	38	760

3. One hundred and nineteen right hand and 103 left hand samplings taken of the best of the first three trials from each of two successive days following ten day interims of thirteen subjects.
4. One hundred fifteen samplings taken of the best of the first three trials from each of two successive days following ten day interims of all subjects.

By the same method correlations were computed to determine the minimal number of trials necessary to give a reliable evaluation of performance. The data for this set of correlations were selected as follows:

1. For the first trial with the best of the first three trials:
   a. The scores for the total test period for each of three subjects who were selected for their divergence of coefficients of variation (subjects 6, 9, 11).
   b. One hundred samplings composed of scores for the first ten days of one subject, for the second ten days of a second subject, for the third ten days of a third subject,, etc.
2. For the best of the first three trials with the best of ten trials:
   a. One hundred and twenty-five samplings of the scores for every tenth day of all subjects.
   b. The scores of the first, the fifteenth and the twenty-third day of all subjects.

The significance of the increase in muscle strength during a protracted period of repetition of the test was determined for 10 subjects by standard statistical procedures applied to the scores of the initial ten days and those of the ten days showing peak strength.

Results and Their Interpretation

Fundamental statistical data describing the test performance of the subjects are presented in table 2 and are shown graphically in chart 1. The means of the daily averages for all subjects range from 12.75 to 38.36 Kg.; for the left hand and from 16.99 to 46.47 Kg. for the right hand. The spread of the scores around the means varies from individual to individual, as does the comparative variability of the individuals. The possible relationship of this variability to one causative factor (weather) has been discussed by Fischer.[5] The low standard error for the means of all subjects and of the group indicates the high reliability of the means.

The high coefficients of reliability (table 3) are evidence that both the single effort muscle test and the hand dynamometer as a measuring instrument are reliable. The correlations made to determine the minimal number of trials needed to give a reliable evaluation of performance are extremely high, as can be seen from table 4. The correlations of the sampling for both the first trial with the best of three trials and for the best of the first three trials with the best of ten trials not only are high but are so nearly identical (0.97 and 0.99) that for all practical purposes it can be assumed that a single trial is as reliable as either the best of three or the best of ten trials.

Inspection of the graphs of the daily average scores of individual sub-

TABLE 2. — *Fundamental Statistical Data Describing the Test Performance of the Subjects.*

Case No.	Test Days, No.	Hand	Range of Daily Average	Mean of D. A.	Standard Deviation	Standard Error	Coefficient of Variation
1	207	L	31.8-43.4	38.36	2.48	0.12	6.47
		R	28.7-46.0	39.64	3.29	0.16	8.30
2	204	L	10.7-15.6	12.75	.99	0.05	7.73
		R	11.8-28.6	25.36	1.66	0.08	6.56
3	64	L	20.9-33.5	27.31	2.77	0.25	10.15
		R	23.7-34.6	30.30	2.21	0.20	7.30
4	68	L	14.2-23.2	18.84	2.29	0.20	12.15
		R	18.0-27.4	22.12	2.01	0.17	9.08
5	122	L	16.3-23.2	19.66	1.67	0.11	8.50
		R	15.1-25.3	20.78	2.13	0.14	10.25
6	104	L	10.0-24.8	19.00	3.65	0.25	19.21
		R	10.5-24.6	16.99	3.86	0.20	16.86
7	73	L	20.3-31.7	27.23	2.55	0.21	9.37
		R	24.4-34.1	30.79	2.31	0.19	7.49
8	23	L	13.2-19.5	17.17	1.52	0.23	8.86
		R	22.0-27.8	24.52	1.38	0.21	5.62
9	52	L	17.2-22.5	20.21	1.31	0.13	6.50
		R	21.9-27.3	24.50	1.24	0.12	5.05
10	54	L	13.2-26.7	20.24	2.78	0.27	13.74
		R	20.6-32.4	25.93	3.08	0.30	11.90
11	92	L	21.8-29.8	26.14	2.28	0.17	8.74
		R	26.3-37.0	31.82	2.29	0.17	7.21
12	67	L	21.1-31.7	26.36	2.35	0.20	8.93
		R	24.8-35.0	31.19	2.12	0.18	6.79
13	38	L	26.1-37.1	31.61	2.28	0.26	7.20
		R	41.1-51.3	46.47	2.88	0.33	6.20
Mass scores*	964	L	10.0-43.4	25.14	8.14	0.19	32.38
		R	10.5-51.3	29.31	8.81	0.20	30.06

* Subject 2 has a residual paralysis as a result of poliomyelitis and was omitted from this computation.

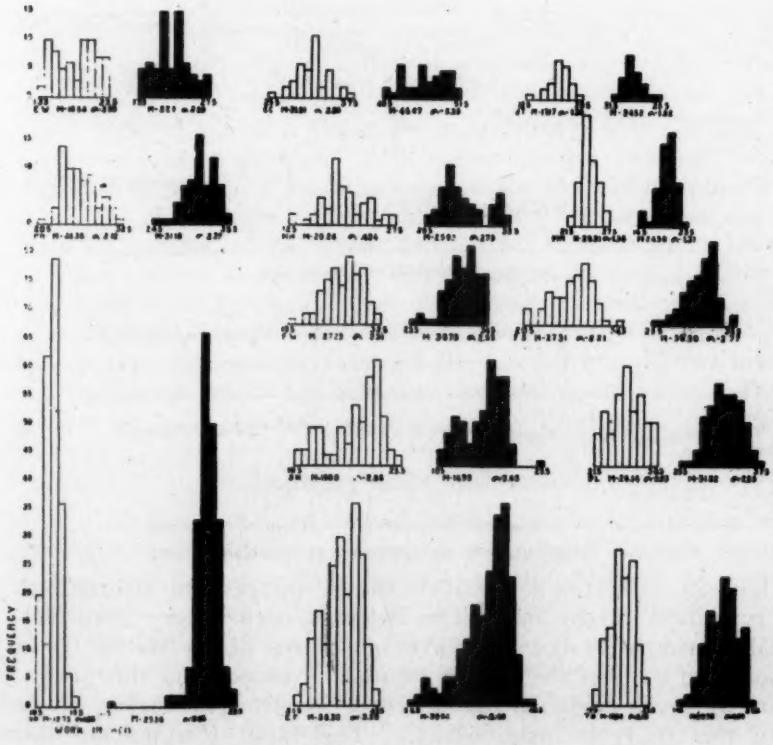

Chart 1. — Histograms illustrating test performance of individual subjects.

TABLE 3. — *The Coefficents Determining the Reliability of the Single Effort Muscle Test and of the Dynamometer.*

	Test Days, No.	Hand	r	Reliability Index	Standard Deviation	Mean of x	Mean of y
x y*	120	R & L	0.94	0.97	0.09	26.63	26.62
x y*	100	R & L	0.94	0.97	0.10	23.73	23.47
x y†	115	R & L	0.93	0.97	0.09	28.28	28.94
x y†[1]	103	L	0.93	0.97	0.10	27.87	28.16
x y†	119	R	0.95	0.97	0.09	30.26	30.66

* x is the first trial score; y is the second trial score of the same day.
† x is the best of first three trial scores; y is the best of the first three trial scores on the succeeding day.
One subject (No. 2) was omitted because of residual paralysis of the left hand.

TABLE 4. — *Correlations Determining the Minimal Number of Trials for Reliable Evaluation of Test Performance.*

		Test days, No.	Hand	r	Significance of r	Standard Deviation	Mean of x	Mean of y
x y*	Case 11	92	R	0.87	8.28	0.10	33.67	34.61
x y*	Case 9	52	R	0.86	6.11	0.14	26.02	26.56
x y*	Case 6	104	R	0.91	9.28	0.10	16.88	18.09
x y*	Random sample	100	L & R	0.97	9.63	0.10	30.63	32.17
x y†	1st day	13	L	0.99	3.43	0.29	23.08	23.54
			R	0.99	3.42	0.29	28.23	29.08
x y†	15th day	13	L	0.99	3.45	0.29	23.92	24.15
			R	0.99	3.46	0.29	29.77	30.00
x y†	23rd day	13	L	0.96	3.34	0.29	24.69	25.54
			R	0.99	3.45	0.29	30.23	30.62
x y†	Random sample	125	L & R	0.99	14.43	0.09	27.58	28.06

* x is the first trial score; y is the best of the first three trial scores.
† x is the best of the first three trial scores; y is the best of ten trial scores.

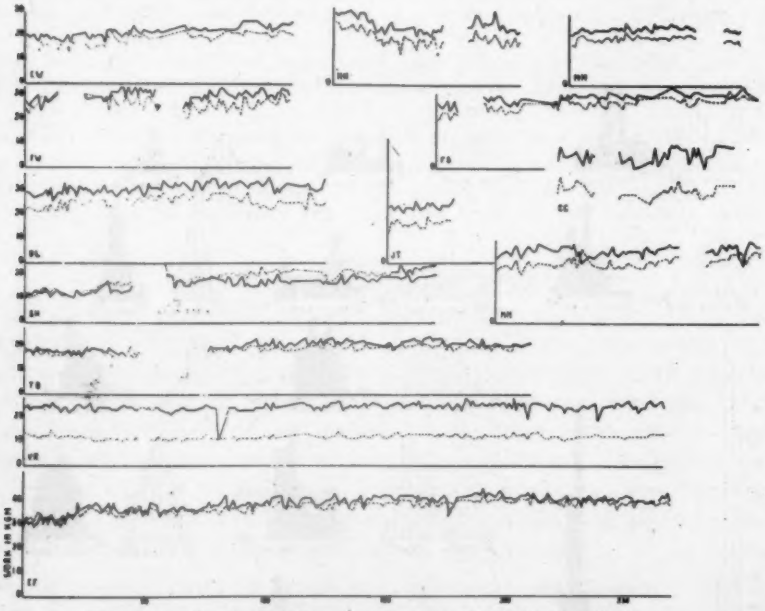

Chart 2. — Graph of daily average scores of individual subjects.

jects (chart 2) indicates a relatively slight increase in strength with protracted repetition of the test. The increase occurs very gradually. The statistical treatment of the daily average scores of the initial ten days and of the peak ten days of the limited number of subjects in this study (table 5 and chart 3) gives evidence that increase in strength during the total test period of this study is insignificant. This lack of significant increase in strength may be due to one or more of the following factors: first, ten

single muscle effort trials daily may not give sufficient exercise to produce conspicuous increase in strength; second, the kilogram may be too gross a unit of measure to detect small increases in strength, and, third, certain environmental, psychologic or physiologic factors not controlled in this experiment may influence the condition of the human machine and the effort put forth by the subject.

TABLE 5. — *Significance of the Difference Between Strength During Initial Stage and Strength During Peak Stage.**

	Test Days, No.	Mean for Initial Stage	Mean for Peak Stage	Diff. of the Means	Standard Error of Diff.	Critical Ratio
Left hand	100	24.48	27.64	3.16	8.89	0.36
Right hand	100	25.96	30.76	4.80	11.97	0.40

* Subjects 2 and 10 were omitted because of the presence of pathologic conditions; subject 8 was omitted because the number of test days for him was only twenty-three.

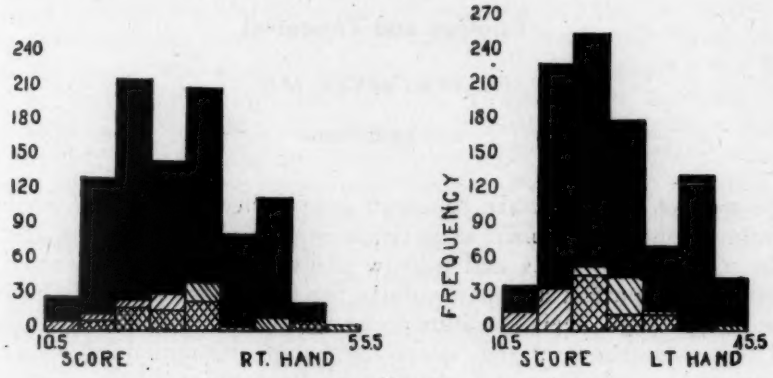

Chart 3. — Histograms illustrating test performance of: (*a*) the total group for the total period shown by the solid columns; (*b*) initial ten days of 10 subjects shown by the cross hatch ///; (*c*) ten days of peak performance of 10 subjects shown by the cross hatch \\\.

Further study of the data shows the occurrence of a phenomenon already noted by Houtz and co-workers.[6] When exercise was resumed after a prolonged layoff following the establishment of the skill, there apparently was little or no loss of strength and in some cases increase occurred. In this study, 4 subjects, after layoff periods of sixty-six days or more, resumed the test with daily average scores higher than those of the period previous to the layoff; 1 subject with an eighty-seven day layoff resumed work at the same score. Paradoxically, two subjects with much shorter layoff periods, fifteen and nineteen days, respectively, resumed the test with a slightly lower score. However, this material is not sufficient to lend itself to statistical proof. Retention curves for motor habits developed by therapeutic exercise require study.

Summary and Conclusions

Thirteen subjects repeated dynamometer tests over a protracted period of time. The scores of these tests served as raw data for a study of the reliability of a single effort muscle test and of the minimal number of trials necessary in clinical practice. The statistical analysis presents evidence from which the following conclusions can be drawn:

1. Within the limits of this study and within the limits of what the dynamometer purports to measure this instrument is a reliable tool.

2. The muscle test studied in this investigation is a reliable measure of strength.

6. Houtz, Sara Jane; Parrish, Annie M., and Hellebrandt, F. A.: The Influence of Heavy Resistance Exercise on Strength, Physiotherapy Rev. 6:299, 1946.

3. A single trial of this test as administered is as reliable as either the best of three or the best of ten trials.

4. Under the conditions of this experiment, there was relatively slight increase in strength from protracted repetition of the dynamometer test.

Attention should be called to an article by Fisher and Birren[7] in which the reliability coefficient for the hand dynamometer are similar to those found in this study. This came to our notice after the present manuscript went to press.

7. Fisher, M. B., and Birren, J. E.: Standardization of a Test of Hand Strength, S. Appl. Psychol. 30:380, 1946.

FOOT STRAIN *

Etiology and Treatment

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SAN FRANCISCO

The subject of foot strain has been approached from many angles. Because women outnumber men as patients complaining of painful feet, in the past the use of high heels and narrow ill-fitting shoes was blamed almost routinely for discomfort and particularly for the deformation of the feet. At present, though high heels continue to be worn, many women suffering from painful feet wear shoes of the "corrective" type recommended either by the physician or the salesman and continue to have painful feet after spending many years in an attempt to find comfortable shoes. As women continue to outnumber men in this regard, we do have to recognize that even the "corrective" shoe with its 1½ to 1¾ inch heel but with its trend to a narrow and inflaring forefoot, is not as satisfactory as is the type of shoe which men wear very comfortably unless particularly heavy strain is placed upon their feet.

In the past few years a study of the foot itself has led to more basic reasons for strain which go far in explaining why the shoes are not comfortable. Schwartz[1] was interested in the study of gait and measured this with the electrobasograph. He developed a shoe which he thought met the specifications for comfort. At about the same time (1932) D. J. Morton[2] reported his findings with regard to native Africans noting particularly the angle of gait. Morton continued his studies and has emphasized certain anatomic variations to explain a large percentage of painful feet. Schwartz and Morton stimulated an interest in the study of the foot itself, in order to find the cause of strain and to explain its familiar distorting elements and, therefore, to give a basis for sound treatment.

The human foot[3] is probably derived from a primitive mammalian foot, retaining its primitiveness supposedly because of the terrestrial habits. Jones has stated the opinion that such a foot belongs to the primitive members of the primate stem, the stem from which man and the other existing members

* From the Department of Physical Medicine, University of California Medical Center.
* Read at the Twenty-Fourth Annual Session of the American Congress of Physical Medicine, New York, Sept. 4, 1946.

1. Schwartz, Plato: The Pneumographic Method of Recording Gait, J. Bone & Joint Surg. 14:783, 1932.

2. Morton, D. J.: The Angle of Gait, J. Bone & Joint Surg. 14:741, 1932.

3. Jones, Frederick Wood: Structure and Function as Seen in the Foot, Williams & Wilkins Company, Baltimore, 1944.

of the primates branched apart and went their separate ways at a very early stage. With the orthograde posture the feet were forced to take on the weight of the body.[4] This demanded an increase in the tarsus both in weight and in size, while the metatarsals and phalanges shortened. The opposing first toe came to lie beside the second. The changes, therefore, that one sees are (1) a progressive reduction of the anterior section (metatarsophalanges) and an increase in the posterior section (tarsus); (2) a change in the relative length of the digits, especially a reduction of the dominant third and an increase in the size of the first; (3) a gradual decrease in the adduction of the first and an incorporation into the main structure of the foot; (4) a downward and backward extension of the os calcis to form a true heel and hence the appearance of a true arch; (5) a notable increase in the rigidity of the foot to fit it for its new purpose.

Therefore, in the normal foot which has developed completely according to evolutionary plan, Morton[5] has shown that the weight of the body is borne by the heel and the metatarsal heads. The static stresses are borne by the rigid framework of the foot, which is made up of bones and ligaments, while the muscles supply the kinetic power, and, aside from keeping the body in balance, act only during locomotion. The weight of the body on the two feet can be divided into 24 units, each foot supporting 12 units. These are equally divided between the os calcis posteriorly and the metatarsal heads anteriorly. The wide first metatarsal head rests on two sesamoid bones each supporting 1 unit, thus making six points of contact with the ground. The foot then represents a triangle with its apex at the os calcis and the opposite side formed by the metatarsal heads. A line drawn from the os calcis should pass between the second and third in erect standing, thus dividing equally the weight-bearing areas. In running, the full weight of the body will be thrust upon the metatarsal heads of one foot (24 units), half of this being thrust upon the first metatarsal head alone. Then a line from the os calcis falls between the first and second metatarsals.

The weight of the body is transmitted through the astragalus (talus) to the os calcis, which forms a table upon which it rests. The bones of the midtarsal region represents a dome-shaped transverse arching, increasing the structural strength for forces applied vertically and converging the stresses toward the separate metatarsals, which are arched proximally but flattened distally so that their heads lie in a single plane.

The first metatarsal, then, is of particular importance to the internal mechanism of the foot: 1. It supports the medial side of the foot and prevents depression of the sustentaculum tali, thus preventing pronation. 2. It supports a major share of static stresses in locomotion. 3. It gives support to the astragalus, which is the center from which static stresses are distributed.

Any failure of normal evolutionary development, then, which interferes with the stability of the first metatarsal or changes the balance of weight-bearing so that the foot cannot conform to shoes or to long standing on hard surfaces is a potential cause for strain.

Study of the Painful Foot

The patient may complain of a painful bunion or of pain in the region of the metatarsophalangeal joints or perhaps of a feeling of strain in the region of the astragalo-scaphoid joint, or even of aching of the calf. Cursory examination reveals such blemishes as corns, calluses and bunions, and ever-

4. Lake, Norman C.: Evolution as an Aetiological Factor in Foot Disorders, Brit. M. J. 1:31, 1942.

sions or inversions. These represent results of strain and not the primary cause (fig. 1).

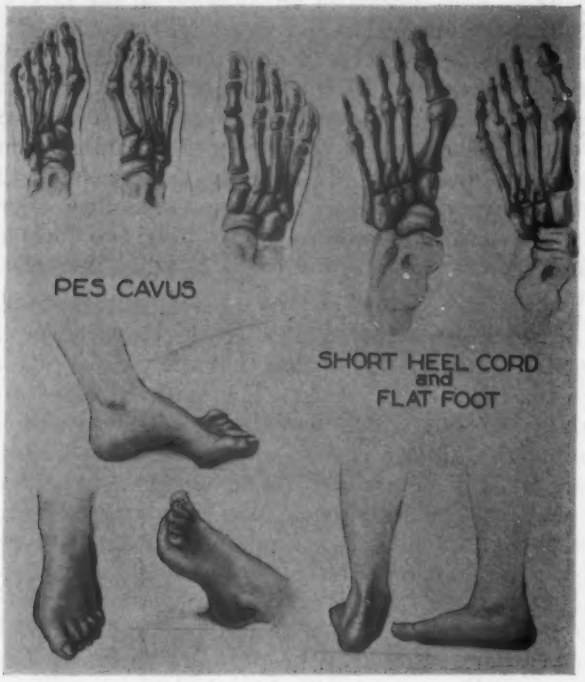

Fig. 1. — Congenital abnormalities of Feet

Barring severe trauma, paralyses, infections, etc., true foot strain can be attributed to certain deviations from the so-called normal foot which are inherited and represent a failure of full evolutionary development. Morton[5] has defined certain anatomic variations which lead to definite strain: (1) a short first metatarsal, or (2) posteriorly placed sesamoids under the first metatarsal, and (3) hypermobility of the first metatarsal segments (including the first cuneiform bone which moves with the metatarsal). The short heel cord is considered as an extrinsic factor.

He does not mention the metatarsus primus varus which is seen so frequently, but it does belong under the heading of "hypermobility of the first metatarsal segment." It has been discussed by many authors. Lapidus[6] described this condition as a primary cause of hallux valgus, since a large degree of angulation (10 to 19 degrees) exists between the first and second metatarsals with the first metatarsal in abduction (fig. 2).

I wish to add still another factor closely related to these as a cause of strain, namely, metatarsus varus, or a varus of the entire forefoot. In the literature this condition is not described in discussions of the adult foot. Sweetapple[7] stated that the varus position of the forefoot seen in infants disappears completely by the close of the first year. Chandler[8] stated that "metatarsus varus in the infant yields to manipulation and cast therapy," and that "for the older child, more radical procedures become necessary." Haas[9] mentioned it as accompanying a condition of hallux varus in a child

5. Morton, D. J.: Biomechanics of the Human Foot, Lectures on Reconstruction Surgery of the Extremities, New York, Columbia University Press, 1944, p. 92. The Human Foot, Columbia University Press, 1935; New York. Foot Disorders in General Practice, J. A. M. A. 109:1112 (Oct. 2) 1937.

6. Lapidus, Paul W.: Operative Correction of the Metatarsus Varus Primus in Hallux Valgus, Surg., Gynec. & Obst. 58:183, 1934.

7. Sweetapple, H. A.: A Study of the Feet of New Born Infants, M. J. Australia 1:892, 1932.

8. Chandler, Fremont A.: Children's Feet, Normal and Presenting Common Abnormalities, Am. J. Dis. Child. 63:1136, 1942.

9. Haas, S. L.: An Operation for the Correction of Hallux Varus, J. Bone & Joint Surg. 20:705, 1938.

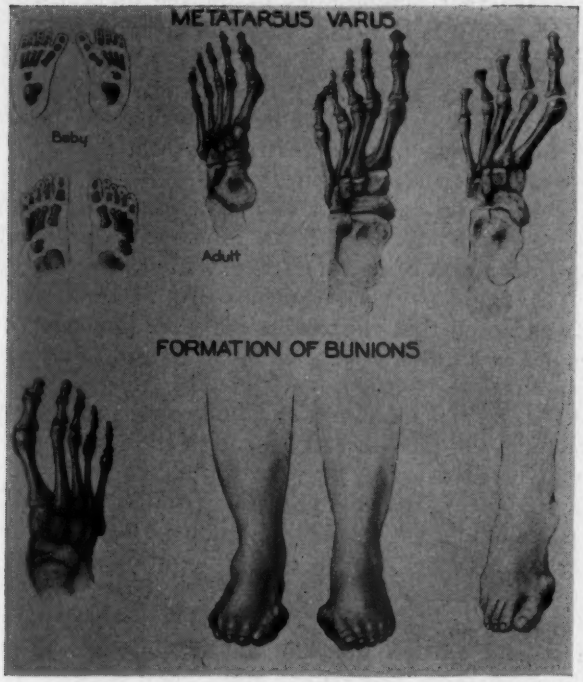

Fig. 2. — Metatarsus varus. Formation of Bunions

Fig. 3. — Lines drawn from the center of the os calcis at its posterior margin and extended to the center of the base of each metatarsal should pass through the entire length of the metatarsal. The angle of deviation is formed by the line extended from the os calcis with one through the center of the metatarsal. The angle of deviation of metatarsus I with metatarsus II is illustrated.

of 3 years and stated that osteotomies of all the metatarsals in addition to the correction of the hallux varus may be necessary.

During the past few years I have seen an increasing number of patients suffering from foot strain, and as my interest has increased further search for the underlying cause has become more intensive. Metatarsus varus without evidence of metatarsus primus varus was first noted in a patient who had for twenty years been trying many types of shoes in an attempt to obtain comfort. She had no calluses and no bunions, and examination of her feet clinically revealed no abnormality. However, the roentgenograms revealed the inward deviation of the metatarsals the second showing a deviation of 7 degrees. The angle between the first and second metatarsals was 10 degrees; and it was noted that the sesamoids were posteriorly placed, though the first and second metatarsals were equal in length. Though there was an appearance of hallux valgus roentgenologically, this was not evident clinically. Since in the normal foot lines can be drawn from the posterior center of the os calcis which will pass directly through the center of each metatarsal, any deviation can be measured (fig. 3). In the roentgenogram of the foot showing metatarsus varus, the line is drawn from the os calcis to the center of the base of the metartarsal whose deviation is to be measured and a line is drawn through the center of the entire metatarsal. The angle that the line from the os calcis makes with the line drawn through the metatarsal is the angle of deviation. Likewise, one can measure the angle of deviation between the first and second metatarsals by drawing lines through their centers and extending them posteriorly until they bisect. It is to be noted that when metartarsus varus accompanies a metatarsus primus varus the point of bisection lies posterior to the center of the os calcis rather than anteriorly, as it would with the first metatarsal alone involved.

I have seen as private patients 207 persons with possible disorders of the feet. Twenty of these had not had a diagnosis. Of 77 adults, almost all of whom were women, 55 showed definite abnormality of the first metatarsal or a metatarsus varus; of persons under 20 years, 13 of 41 showed a varus of the forefoot or variations of the first metatarsal. Of 69 infants, 55 had metatarsus varus with or without a wide angulation between the first and second metatarsals.

Certain skeletal abnormalities, such as accessory scaphoids, which cause an incorrect pull on the medial surface of the tarsus by the tibialis postieus muscle,[10] or pes cavus, or flat foot, or coalitions such as may exist between calcaneus and navicular are at times found and explain the discomfort. However, most strain is due to severe stresses placed upon a foot which deviates from the normal in its anterior weight-bearing surface. It is capable of maintaining its position as a support for the body adequately when not subjected to hard surfaces and to footwear that is built for feet which have more nearly reached present evolutionary development.

In a large percentage of both the adolescent and the adult patients another factor is noted, namely, the short heel cord. Morton called this an extrinsic factor. It is seen at times in small children, but after the age of 6 it is frequently noted and is often accompanied by short hamstrings as well. It exerts its pull on the lateroposterior surface of the os calcis, thus tilting it and forcing the astragalus to shift downward and inward into pronation to cause a strain upon the ligamentous structures.

The painful foot in a large proportion of cases, then, can be ascribed to certain structural abnormalities which are inherited and are due to deviations from normal evolutionary development which prevents the proper

10. Kidner, F. C.: Accessory Scaphoid, J. Bone & Joint Surg. 11:831, 1929.

distribution of weight between the os calcis posteriorly and the metatarsal heads anteriorly; and the proper distribution of weight between the metatarsal heads, themselves, as the increased weight is carried forward onto them in locomotion. The superficial evidences of strain are corns, calluses, bunions, clawing, inversions, eversions, spasm of muscles (peroneals) and increasing loss of flexibility. The intrinsic causes are: (1) short first metatarsal; (2) posteriorly placed sesamoids under the first metatarsal; (3) hypermobility of the first metatarsal segment; (4) metatarsus primus varus; (5) metatarsus varus with or without metatarsus primus varus, and (6) the very important extrinsic factor, short heel cord.

Examination

Upon inspection of the foot, such blemishes as calluses, corns and bunions are noted. The posture of the foot must be analyzed. The astragalus may roll medially upon the tilted os calcis in pronation of the tarsus, particularly when the first metatarsal is short or hypermobile (fig. 1 and 2). The arch may be high and accompanied with clawing of the phalanges. The web is broad between the first and second metatarsals when metatarsus primus varus is present; the forefoot is broad when metatarsus varus or primus varus exists. If the heel cord is short, the foot cannot be flexed to 90 degrees when the knee is extended. This condition frequently accompanies either pes cavus or pronation and exaggerates these deforming elements. Limitation of motion throughout the foot but particularly the lateral mobility of the subastragaloid joint, the decrease in dorsal flexion of the first metatarsophalangeal joint and the dorsal subluxation of the phalanges on the metatarsals are to be measured (figs. 4 and 5).

Roentgen examination is always important. Abnormalities in the tarsus may be present and must be looked for (accessory scaphoids, coalitions, relation of bones of tarsus, disease). In most instances the cause of imbalance will be found in the forefoot. I like a routine lateral view; a dorsoplantar view which will give the outline of the dorsum of the os calcis, and a dorsoplantar view taken with weight bearing. Aside from revealing abnormalities in the tarsus, the lateral view is of value in showing variations in the relationship of the bones. The dorsoplantar view reveals the comparative length of the first metatarsal, the position of the sesamoid bones, the spacing between the first and second cuneiform bones (a widened space indicating hypermobility), the angle between the first and second metatarsals, increase in the thickness of the shaft of the second metatarsal and possibly the third which indicates an increase in their proportion of weight bearing due to the poorly functioning first metatarsal and, finally, medial deviations of the metatarsals other than the first with possible thickening and torsion of their shafts. The dorsoplantar view taken with the body in the erect position usually exaggerates the angle of varus and spreads the foot.

Treatment

The abnormalities are familial, as has been stated previously. It is very rare that they canont be traced easily. If there is no severe strain placed on the feet and if shoes are causing no constriction to the forefoot, no symptoms arise. As a rule, men have little trouble. However, Bingham[11] has reported 10 per cent of the soldier patients in the orthopedic clinic of the Station Hospital at Camp Van Dorn who complained of painful feet were found to have Morton's syndrome or congenital insufficiency of the first metatarsal segment. Women wearing relatively high heels and narrow shoes

11. Bingham, Robert: Painful Feet, J. A. M. A. 124:283 (Jan. 29) 1944.

suffer severely. These feet are strong in themselves if they can be supplied with a natural environment where the earth will supply the flexible support which they require.

Treatment consists in fitting the foot with a wide shoe, frequently an E, flexible enough to permit the forefoot to take its normal position or a supporting shoe with a straight inside last. No shoe is built to fit this foot. The width of the anterior part of the foot should be measured in the weight-

Fig. 4. — *A*, metatarsus varus with deviation of 18 degrees. *B*, lateral view of same feet, showing secondary deformities of per cavus and clawed phalanges.

bearing position, as the ease with which it can be compressed tends to result in fitting it with a shoe which is far too narrow. When the forefoot is properly fitted, the heel of the shoe now obtainable is usually much too large; hence this has to be corrected. The heel must be low, not more than 1½

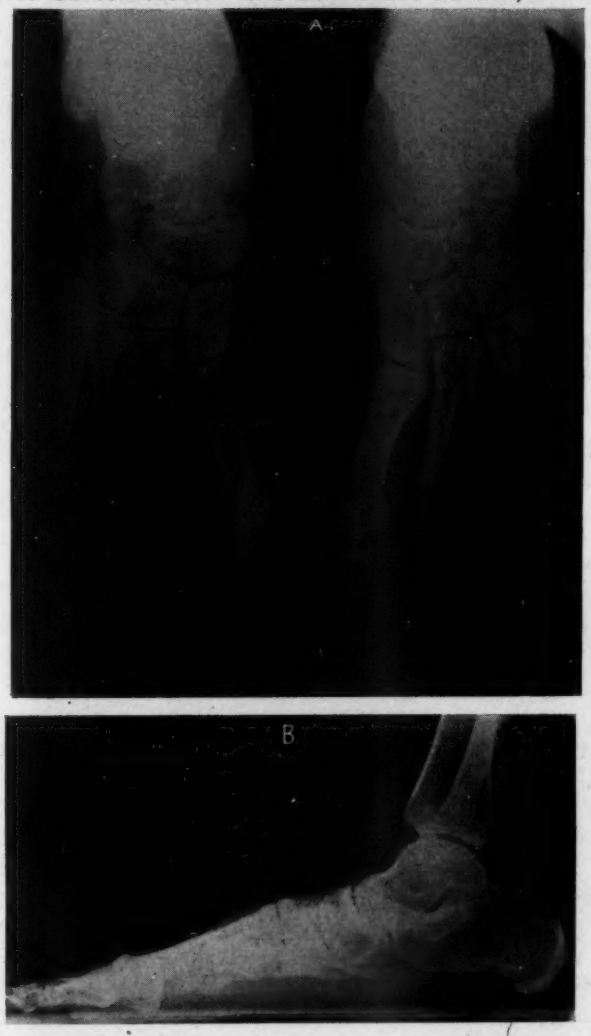

Fig. 5. — *A*, metatarsus varus of 8 degrees. *B*, lateral view, one of the same feet, showing a lowering of tarsus.

inches in height (12/8 to 10/8), to prevent thrust onto the metatarsal heads, particularly when the first is short and hypermobile. Sandals and wedgies are comfortable if flexibility of the foot has not been lost. These permit the foot to take its normal position without forcing it into adduction and are satisfactory for either metatarsus primus varus or metatarsus varus. A pad of felt (fig. 6), rubber or leather to lift the first metatarsal head when it is short or hypermobile stabilizes it and takes the thrust from the second, thus stopping the formation of calluses.

Flexibility must be regained. If the feet are very painful, heat, massage, stretching and active exercise to regain freedom of motion in all joints is important. If the spasm is not severe, simple stretching by the patient is possible to regain movement at the metatarsophalangeal joints and throughout the tarsus. It may be well to train the abductor hallucis to

Fig. 6. — Felt pads shaped and beveled to support metatarsus I and also II and III with lift along longitudinal arch, and one cut to lift the head of metatarsus I only, thus stabilizing it. The felt is 3/8 inch thick.

abduct the first toe and to train the tibialis muscles to elevate the medial side of the tarsus, in order to regain the feeling of correct posture. But if flexibility is obtained and the foot is correctly supported, the muscles are forced to act upon the skeletal structures in normal manner. If the calf muscles are short, exercises must be given to stretch them:

1. Knee straight, passively stretch, with the operator's hand exerting its pressure in the longitudinal arch.
2. Actively stretch with one knee flexed and the opposite leg extended backward, with the foot straight, in an attempt to touch the floor with the heel.

Finally bunions can be removed. Operations (Lapidus) may be attempted to bring the first metatarsal into adduction, but further shortening of the metatarsal must be avoided. If metatarsus varus of the entire forefoot is present, this operation cannot be so satisfactory.

Recognizing that metatarsus varus does not disappear in childhood but persists in the adult foot, the question arises as to what correction should be attempted in infants. The amount of metatarsus varus in babies varies tremendously (fig. 7). Two infants in my series gave the appearance of having clubbed feet, showing not only a pronounced varus deformity but the inversion of the tarsus and the short heel cords as well. The ease with which the last two elements were corrected with casts seemed enough to rule out true clubfoot, but the varus deformity in one has remained to a considerable degree (fig. 8); the other is in process of correction and at 1 year shows a good improvement. I have placed casts on 28 of the 55 babies seen. Improvement results, and, if it is decided that it is important to force a correction, then casts are necessary, as no other simple support, such as a leather mold, will produce a shift in the forefoot. Casting is started at as early an age as possible and carried on for at least four to five months. The casts are applied one week and wedged open on the medial side at the tarsometatarsal junction the next week. They are changed completely every two weeks. Inasmuch as this condition is an inherited characteristic, the growth factor has to be considered, and, though the varus deformity can be corrected, if a wide angle is present between the first and second metatarsals this tends to persist.

When the condition is severe, there is often a tight medial band of soft tissue which is hard to stretch (11 of 53). When the varus is severe, and particularly when this medial band is present, I believe that casts should be used until shoes of good quality can be fitted. Though the first metatarsal

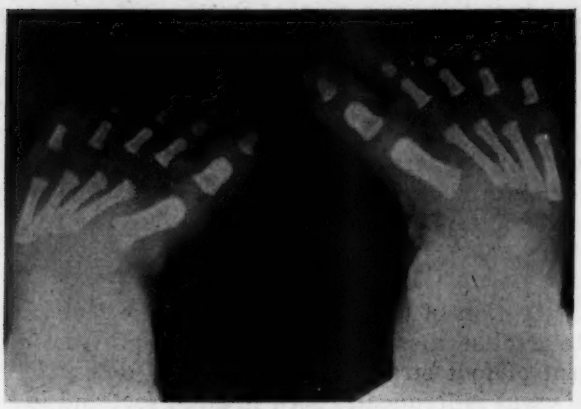

Fig. 7. — Metatarsus varus in child of 3 months

may not entirely lose its broad angle with the second, the whole forefoot will be brought into better line with the tarsus and the ratio of weight-bearing is improved. This in itself will permit the wearing of a more usual shoe. After the casts are removed, as the child is beginning to walk, shoes can be fitted to the opposite foot, and later the pronator type of shoe can be used or shoes of good quality can have an 1/8 to 3/8 inch lift on the lateral part

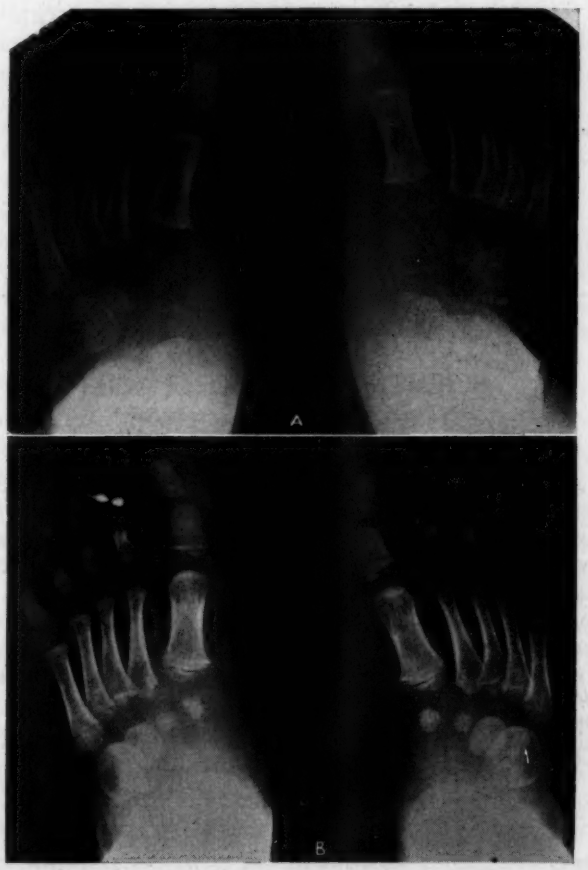

Fig. 8. — *A*, metatarsus varus in a child of 2 years treated in infancy with leather molds rather than casts. *B*, the same feet at 4 years. The boy is wearing corrective shoes with lifts on lateral portion of the sole and medial portion of the heel.

of the sole and medial portion of the heel to thrust the forefoot into line with the tarsus. It is particularly important that the shoes be closely and accurately fitted.

When the varus deformity is of a moderate degree and passive correction is easily obtained, stretching by grasping the tarsus and moving the metatarsals lateralward at the tarsometatarsal joints should be done many times each day. When firm shoes can be obtained, they can be applied with the corrections described previously.

Summary and Conclusions

Morton's conception of the biomechanics of the foot and the importance of the first metatarsal segment in weight bearing provides an excellent basis for the treatment of foot strain.

Metatarsus varus is frequently seen in adult feet and is a cause of strain. It can be present with metatarsus primus varus, with Morton's syndrome of short first metatarsal and hypermobility of the first metatarsal segment, or it can be present without evidence of these, in which case it is impossible to recognize without roentgenograms.

Shoes which give adequate space for the forefoot will relieve the strain. Metal or hard leather support is to be avoided, but soft leather, rubber or felt pads can be used to lift the first metatarsal and to take the pressure from the second and third metatarsal heads.

Necessary correction of deformities by a program to regain normal range of movement should have first consideration. Removal of exostoses is important, and a correction of the alinement of the first metatarsal may be indicated.

Metatarsus varus should be recognized by pediatricians, and correction should be undertaken when the condition is pronounced.

SCIENTIFIC EXHIBIT SPACE
25TH ANNUAL SESSION

A limited number of spaces are available for scientific exhibits. The maximum background allowance will be 8 feet with side walls of 5 feet. Each exhibitor will be allowed one space. All applications for scientific exhibit space must be received at the Congress office no later than June 1, 1947. Circumstances will make it necessary to accept only those deemed most worthwhile by the committee. Write for application to the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2, Illinois.

PHYSICAL MEDICINE IN THE ARMY *

LIEUTENANT COLONEL BENJAMIN A. STRICKLAND, JR.

Medical Corps, United States Army

Although it has become of major importance only comparatively recently, no branch of medical science could, if it so desired, rest more securely on its record of achievement than physical medicine. Prior to 1918 physical methods in the treatment of disease and injury and in the acceleration of convalescence were little used by physicians. Such pioneers as Dr. Simon Baruch were indeed rare. In 1923, Dr. Frank B. Granger, in his presidential address before the first convention of the original group of physicians interested in physical medicine, stated, "The World War resulted in the real birth of this branch of medicine, and as a result it has come to assume its rightful place in the medical world."

Constant progress characterized the field of physical medicine during the period of peace between the two great wars. The additional impetus given by the universal recognition of its rich contribution to the reclamation of World War II casualties is of tremendous significance. Those of least perspicacity must now realize that a new medical specialty has emerged.

The standards of medical literature on physical medicine during the past ten years have been raised to a point where those responsible may be justifiably proud. However, room for improvement still exists. It is the responsibility and trust of all who are engaged in this fascinating field never to speak simply to be heard, never to write merely to see themselves in print, but always to be scientifically honest and critically analytical of all their efforts.

Many worth while innovations and valuable practices in physical medicine have been primarily developed by those workers in other specialized fields, such as orthopedics and internal medicine. This can be interpreted only as an indication of the scientific soundness and therapeutic versatility of physical medicine. But the specialists in physical medicine themselves, with intuitive vision, constant initiative and scientific acumen, must be the ones to take the lead in developing and expanding its scope of usefulness.

In Army medicine the degree of professional or scientific esteem in which a particular activity or endeavor is regarded, is a direct reflection of the status in civilian medical circles of that particular endeavor. It is therefore of the greatest concern and interest to one who will remain in the service that the development and progress of his particular field or specialty in civilian circles be along the soundest lines and of the highest standards. The field of physical medicine at large is now developing in such a manner, but careful stewardship and searching introspection must be the rule. Robert Burns' plea which asks in part for the power "to see oursel'es as ithers see us," should be the constant prayer of all who are engaged in this vast and promising field. All tendencies toward a dulling of scientific perspective by overenthusiasm must be guarded against. In some instances this practice has not been followed carefully in the past. However, the present soundly conceived and competently organized trend of development in physical medicine leaves small grounds for criticism on this score.

It has been thought worth while to present this discussion in three main parts: first, physical medicine in the Army in the past; second, the present

* Read at the Twenty-Fourth Annual Session of the American Congress of Physical Medicine, New York, Sept. 4, 1946.

status of physical medicine in the Army; and, third, future plans for physical medicine in the Army.

Physical Medicine in the Army in the Past

In the Medical Department of the Army, physical medicine has had an extensive and gratifying history, and since the first World War it has been fully recognized as a powerful adjunct to the therapeutic armamentarium.

The struggles and accomplishments of Physical Medicine during the first World War are well recorded in volume 13, part I, of the "History of the Medical Department of the U. S. Army in the World War." Upon perusal of this record, it is readily apparent that many of the lessons learned and procedures and technics utilized were identically applied in World War II, the only difference being a change in terminology and a utilization on a much larger scale in the latter instance.

As is generally known during the first World War, extensive utilization was made of the then-termed "Physiotherapy, Occupational Therapy and Physical Reconstruction Services." On Nov. 15, 1917, Major Frank B. Granger, Medical Corps, was designated as director of the Physiotherapy Service of the Reconstruction Division. Under Major Granger's administrative and professional genius, careful selection of personnel was made, standardization of apparatus was accomplished and physical therapy departments were provided for on a large scale. Physical reconstruction divisions with adequate physiotherapy units were, in 1919, functioning in 35 General Hospitals and 18 Base Hospitals scattered throughout the United States. Altogether, the Physiotherapy Service of the Reconstruction Department made it possible from March, 1918 to March, 1920 for about 86,000 disabled soldiers to receive the benefit of over 3,500,000 treatments. This does not include additional thousands who were treated in France.

It has been said that in the first World War there was no equivalent activity of what is known today as Physical Reconditioning, and most persons consider it a new field, developed during the early days of World War II, but such is not the case. A series of most interesting facts have been disclosed by Colonel Hew B. McMurdo, Commanding Officer of Oliver General Hospital, who has had a distinguished career of thirty years as a medical officer in the Army.

The following statement is quoted from a recent communication from Colonel McMurdo:

> While at Base Hospital No. 3 at Brownsville, Texas, in early 1918, I prescribed five sets of exercises, which were all done outside the hospital building. These exercises were graduated from Number 1, which was mild, to Number 5, which was very strenuous. Number 5 included double time and hurdle jumping and was considered roughly equivalent to full duty in the field. When Number 5 exercise was completed, the patient was discharged as well and sent to his station in the Brownsville District on full duty status. Many of the commanding officers wrote back to me with genuine enthusiasm, saying that this new procedure greatly aided their training programs. These exercises and plan were my own idea, and if anyone else was doing it, I did not know it. After the program had been going well for a couple of months I wrote about it to the Department Surgeon, and asked that he try it out in some other places. He did not evince much enthusiasm over the idea, but stated that "it was a step in the right direction."

During the peacetime years, physical therapy departments and occupational therapy departments were continued on a conservative basis in the few larger Army hospitals, but in most instances these activities were only nominally supervised by a medical officer. Despite this conservatism, a considerable number of the older officers exercised keen vision and foresight

in advocating and supporting these activities. The tremendous utilization of fever therapy in the Army was illustrative of this fact.

The first step in alerting physical medicine for the important part which it was to play in World War II occurred in the Summer of 1941, when the Division of Medical Sciences of the National Research Council formed a subcommittee on physical therapy. It was my privilege to attend the meetings of this subcommittee as liaison officer for the Medical Department of the Army. Specific needs were discussed and several problems attacked, but, for reasons beyond the control of the group, not much of a concrete nature was accomplished. However, the members of this subcommittee contributed much in the nature of progressive thinking. One particularly noteworthy incident occurred at one of the meetings in August, 1941. The chairman of the committee, Dr. John Stanley Coulter, gave his estimate of the number of physical therapy technicians that the Army would need in case of war. It must be remembered that no one had even dared guess what the strength of the Army would be if war came. Dr. Coulter's estimate was 1,500, which in retrospect reveals an almost prophetic quality and comprehension of the need.

With the advent of hostilities in December, 1941 and the beginning of mobilization of the entire field of medicine, prompt action was necessary. Newly commissioned medical officers who had been engaged in physical medicine as civilian physicians were assigned to the larger Army hospitals. Leading medical institutions, such as Mayo Clinic and Northwestern University Medical School, were requested to expand quickly their training of officers in Physical Medicine.

The survey of the original Baruch Committee on Physical Medicine, which began in the fall of 1943, provided a remarkable stimulation for this field in the military service. The representative of the Army obtained from all the named Army General Hospitals exhaustive data regarding the status of physical medicine in military hospitals. Extracts of this data may be found in the original report of the Baruch Committee. It was found that physical medicine was being broadly utilized with gratifying results in United States Army hospitals.

The definitive therapeutic value of physical therapy became so well appreciated that special attention was devoted to it in the smaller station hospitals and dispensaries. Colonel Alfred R. Shands, Jr., who was Chief of the Surgical Division in the Office of the Air Surgeon, made a particularly noteworthy contribution. There was conceived by Colonel Shands the idea of a circuit-riding team which he personally organized and sent to the smaller Air Forces station hospitals to give training in elementary physical therapy technic. This team consisted of medical officers specially trained in physical therapy and technicians qualified as instructors for enlisted personnel. A great deal was accomplished in raising the standards of physical therapy in the smaller station hospitals.

In the medical installations overseas, both large and small, physical therapy was used to an extraordinary degree, oftentimes under considerable handicaps and obstacles. At small Air Forces dispensaries in the jungles of India and Burma and in the mountains and rice fields of China I have seen young medical officers develop improvised physical therapy equipment with amazing results. In Japan only three weeks after the arrival of Allied occupation forces I saw physical therapy departments in operation. I saw confiscated Japanese equipment and apparatus, which, incidentally, was generally of the type used by the United States forces in the early 1930's utilized with strikingly good results.

The monumental work of Rusk in the reconditioning of convalescent pa-

tients brought into full recognition the inestimable value of certain aspects of physical medicine. All the armed services then developed vast and elaborate programs which paid off handsomely. Reconditioning was applied to almost all types of disease and injury and in some instances was used in a revolutionary manner.

Many physicians know of the large numbers of military personnel who contracted rheumatic fever during 1942 and 1943 in certain areas of the United States. During 1943 and 1944, while serving as commanding officer of the Army Air Forces Regional Hospital at Tucson, Ariz., I had the opportunity to observe and follow the course of some 300 such patients. These patients had been evacuated from areas in Utah, Colorado and other regions where the incidence of recurrence was high. In the sunshine and low humidity of southern Arizona many of them rapidly became active in the physical reconditioning program and convalesced to full return to duty. One case worthy of special mention was that of an aviation cadet who had contracted rheumatic fever just as he finished preflight training. He had a moderately loud systolic murmur but no other evidence of residuals. This cadet, if handled in the conventional manner, would have been discharged from the service and condemned to a life of limited physical activity. Instead, he was allowed, under the individualized Physical Reconditioning Program, to begin a regimen of physical activity which soon advanced to participation in such strenuous sports as golf and skiing. The heart murmur almost disappeared, and he was reinstated in his aviation cadet training. He graduated and became a pilot of an A-26, one of the fastest attack bombers, and is today living a completely normal life.

In the Army the efforts in reconditioning under the able direction of Colonel Augustus Thorndike achieved new heights and opened new paths in the management of convalescence. With the cessation of hostilities, followed by the rapid demobilization of the Army, the necessity for reconditioning continued, but on a smaller scale. However, the portions of reconditioning of proven value have been and will be continued.

Present Status of Physical Medicine in the Army

Among the staunchest advocates of the scientific value of physical medicine today are the officers of the Medical Corps who began their careers prior to and during the first World War. These men are particularly cognizant of the great contribution that this field of medicine has made to the medical practice. Such outstanding officers are the leaders of the Medical Department of the Army at present, and, through their rich experience gained from long Army careers including two great wars, are the strongest supporters of physical medicine. At the recent meeting of the American Medical Association the following statement was made: "Civilian hospitals should follow the lead of military hospitals in better coordination of Physical Therapy, Occupational Therapy and rehabilitation under the direction of a qualified medical specialist in Physical Medicine." This statement is a tribute to the sagacity and discrimination of the guiding figures of the Medical Department of the Army.

The present Surgeon General is giving the utmost support in establishing Physical Medicine on a prominent scale. On his orders, there was established on April 15, 1946 in the Office of the Surgeon General a Physical Medicine Consultants Division. This division is comprised of the three sections, Physical Therapy, Occupational Therapy and Physical Reconditioning. Its mission is to provide overall supervision of Medical Department activities in physical therapy, occupational therapy and physical reconditioning.

Concurrently the Reconditioning Consultants Division was abolished, and the educational and other nonmedical aspects of reconditioning were placed under the Convalescent Services Branch of the Hospital Division. The mission of Convalescent Services is to provide certain nonprofessional and nonmedical services for hospitalized soldiers.

In reconditioning, certain modifications are now necessary because of the gradual reduction of the size of the Army to a peacetime basis. The trend of convalescent care must shift toward the conditioning of soldiers for return to military duty, rather than for a return to civilian life. This trend in the change of emphasis naturally applies to the type of activities utilized in the program. The prevocational activities, particularly those requiring large staffs, heavy equipment and extensive shops, are gradually being replaced by simpler types of activity aimed toward returning the patients to military duty.

In the larger Army hospitals a physical medicine service is now being established, comprising physical therapy, occupational therapy, and physical reconditioning. Educational and other nonmedical aspects of reconditioning are being placed under Convalescent Services. Therefore, none of the valuable contributions of the wartime field of reconditioning will be relegated to obscurity, and its cleavage into physical reconditioning and educational reconditioning will not be allowed to lessen the careful professional supervision which is so necessary in the efficient handling of convalescent patients.

This reorganization will be completely effective in placing the purely medical aspects of reconditioning under the Physical Medicine Service headed by a physician trained in the carefully integrated application of the triad physical therapy, occupational therapy and physical reconditioning.

The present status of physical medicine in the Army presents a single great problem upon which all others are dependent. This problem is the acute shortage of medical officers trained in this field. Specialists in other fields in the Army have likewise been reduced to an alarmingly low number by demobilization since V-J Day.

The observation has been recently made that physical medicine has now come of age. It may be appropriately added that, although physical medicine has come of age, in the Army it is at the moment deplorably undernourished from the standpoint of personnel.

As of Aug. 30, 1946, there are three regular Army medical officers assigned to full-time duties in this field, and thirteen other temporary medical officers are being utilized in physical medicine. It is estimated that twenty-three additional medical officers with training in physical medicine are needed today to staff the larger Army hospitals properly. Vigorous steps are being taken to solve this problem, and definite plans have been formulated and are being put into action.

Experience has proved that to attempt to make a medical officer a specialist by order is most disappointing. Hence, the approach to this problem is to obtain for assignment and training in physical medicine those persons who have an interest and desire to enter this field. A considerable number of younger Regular Army medical officers are being contacted, and the opportunities and advantages of a career in physical medicine are being pointed out to them. These young medical officers, who during the war were of necessity assigned to administrative duties, are now interested in entering a medical specialty of recognized standing and in which American Board certification may be obtained. The question is unanimously asked by these men, "Will there be a Specialty Board established in Physical Medicine, and if so, when?" It is of the utmost importance in obtaining high caliber medical

officers for these assignments in the Army that an American Board of Physical Medicine be established in the immediate future.

The training of Army medical officers in physical medicine presents a problem of considerable magnitude. After statements of the desire for such training on the part of a medical officer have been obtained, the obvious question arises as to how and where this training should be carried out.

In solving this problem, two possible solutions are apparent: first, training in Medical Department installations and, second, training in the leading civilian teaching institutions. Both solutions are going to be utilized. However, it is important at this time that the medical officers who are later to carry out the training in Army hospitals be trained themselves. An intensive basic course in biophysics for these officers is mandatory. They must be given the opportunity to study, observe and become acquainted with the multiple broad viewpoints of clinical application of physical medicine as utilized in the leading civilian institutions.

Therefore, plans have been formulated to enlist the cooperation of the leading clinicians and educators in physical medicine in civilian circles. If such cooperation is obtained and facilities made available, physical medicine in the Army will be of the highest professional standards. If such cooperation is not enthusiastically and wholeheartedly afforded, the attainment of high standards and initiation of important training activities in physical medicine in the Army will be seriously impeded.

Initial steps which have been taken indicate that only the finest cooperation will be forthcoming.

Future plans for Physical Medicine in the Army

If the permanent Army consists of 850,000, there will be required a constant level of approximately thirty-three medical officers adequately trained in Physical Medicine. Despite the scheduled closing of several Army general hospitals, it is estimated that the need exists for training fifteen medical officers before July 1, 1947. In the fiscal year beginning July 1, 1947, a total of twenty medical officers must be trained in physical medicine. For future planning, it will be possible to consider the training of only a small portion of these projected numbers in civilian medical institutions. The remainder will have to be trained in Army general hospitals, as stated previously. This formula calls for the use of only a small amount of formal didactic instruction, which will be supplemented by extensive applicatory on-the-job training in the physical medicine service. In order to initiate a continuing training program, it is planned to establish residencies in physical medicine at five Army general hospitals.

It is desired to repeat emphatically that the greatest single problem which is to be faced in the immediate future is the critical shortage of medical officer personnel. Unless pay scales of medical officers are revised upward, this problem will become progressively more serious.

There does not exist a need for training female physical therapists and occupational therapists in the near future. There does, however, exist a need for the training of physical reconditioning officers and enlisted technicians. As soon as competent instructors can be assigned to the appropriate training centers, such courses will be resumed.

Controlled clinical studies and research are provided for in future planning for physical medicine in the Army. In the medical services of the armed forces there exists a unique and almost ideal opportunity for such investigation. It is planned to launch a number of such projects as soon as medical officers adequately trained to direct such a program in physical med-

icine are available. Some of these contemplated studies are of the following nature:

1. More extensive controlled studies in the clinical aspects of physical reconditioning along the lines of the work of Rusk at Jefferson Barracks early in the war.
2. Studies in the effects of certain aspects of physical, mental and educational reconditioning on neuropsychiatric patients. This project is to be carried out in collaboration with the Neuropsychiatric Consultants Division and the Convalescent Services Branch of the Hospital Division.
3. Effect of exercise in conjunction with chemotherapy on rate of recovery from certain acute and chronic infections.
4. The effect of electrotherapy on regeneration of peripheral nerves.
5. Controlled studies in the therapeutic values of ultraviolet radiation.

During the war, the armed services medical consultants program was one of the greatest forward steps that has ever been inaugurated in evaluating and improving the quality of medical care given the American soldier. This program is being continued and enlarged in the Army. Prominent civilian physicians in physical medicine will shortly be named as Consultants to the Secretary of War. These consultants will be periodically called to duty for short periods for the purpose of advising, teaching, checking conditions and recommending improvements in the Army's Physical Medicine Program. The expert advice and counsel of these consultants will assure that physical medicine in the Army will measure up to the highest possible standards.

A continuing program, aimed at keeping physical medicine in the forefront in Army circles, will be vigorously carried out. In the Bulletin of the U. S. Army Medical Department, which is the official monthly publication of the Medical Department, there will be included in each issue appropriate information concerning some phase of physical medicine.

These civilian physicians who are appointed as War Department Consultants will be called on to present pertinent discussions on the field of physical medicine to the staffs of Army hospitals.

Recently commissioned medical officers, during their basic course at Brooke Army Medical Center, will be acquainted with the opportunities for a career in physical medicine in the Army. A concerted program aimed at the continuing orientation of the rank and file Medical Corps officers in Physical Medicine will be vigorously prosecuted.

Physical reconditioning and occupational therapy will be individualized in order to handle specific disabilities more efficiently. In lieu of the poorly accepted mass calisthenics, competitive activities of both an individual and a group type will be used.

Conclusions

From the foregoing statements, it may be seen that physical medicine in the Medical Department of the Army is reasonably assured of a bright and far-reaching future. The imminent establishment of physical medicine as a major service in the larger Army hospitals will lead to a broader utilization and a greater usefulness of this branch of medical practice. A closely coordinated and integrated utilization of its three branches, physical therapy, occupational therapy and physical reconditioning, will lead to the opening of new and beneficial spheres in objective treatment and in the management of convalescence.

If present and future personnel obstacles can be surmounted, a well trained group of Army specialists in physical medicine will be available. This group of specialists will constitute a valuable nucleus around which, in

case of a future military emergency, may be built an efficient physical medicine service in the hospitals of an Army of any size.

It is desired to point out again the profound influence which the trend of development in civilian medical circles will have on the future of physical medicine in the Army. This may be summarized by pointing out the following essentials:

1. The early establishment of an American Board of Physical Medicine.
2. The inclusion of competently presented courses in Physical Medicine in the curriculums of all grade A medical schools.
3. The maintenance of high scientific standards in all research in physical medicine.

Of these three, the most important is the urgency for the prompt establishment of the Specialty Board in Physical Medicine. There is advanced the carefully considered opinion that if an American Board of Physical Medicine is not established within the next eighteen months, physical medicine in the Army will be set back ten years.

Absolutely nothing must be allowed to impede the scientific progress of physical medicine or to obstruct its achivement of full and complete affirmation as a recognized medical specialty.

The discussion of this paper will be published in a later issue of the ARCHIVES.

MEDICAL NEWS

Dr. Huddleston to Direct Polio Clinic

Los Angeles County Hospital early this summer will open a complete clinic for the treatment of poliomyelitis patients. Heading the clinic is Dr. O. Leonard Huddleston, director, department of physical medicine of the University of Southern California Medical School, Los Angeles, who directed poliomyelitis treatments at the U. S. Army Fitzsimons General Hospital, Denver, during the war. Los Angeles County furnishes the space, maintenance and most of the personnel, while the research laboratory will come from the university and the foundation, according to Leroy R. Bruce, director of the hospital.

Model Center for Rehabilitation of Handicapped Civilians

Dr. Howard Rusk, former chief of Army Air Forces rehabilitation, told a Washington group which included Mrs. Harry S. Truman and wives of cabinet members that there is need for a model center where civilians with physical handicaps could be given the same kind of rehabilitation accorded wounded servicemen and veterans. A drive for $300,000 has been launched. Dr. Rusk pointed out that while the government is gratefully assisting disabled veterans to retrain themselves for useful lives, 23 million civilians also need rehabilitation.

Army Medical Library Microfilm Service

During the war, the Army Medical Library through its photoduplication services supplied millions of pages of microfilmed medical articles to the armed services and other research agencies. The principal of immediate aid direct to the user, wherever he might be introduced a new technic to assist medical research.

This service is now generally available for civilian physicians, institutions and research workers on a cost basis. This means direct access to the library's enormous resources of medical literature.

A fee of fifty cents is charged for filming any periodical article in a single volume, regardless of length. Microfilm from monographs is furnished at fifty cents for fifty pages or fraction thereof. Photostats are also available at a charge of fifty cents per ten pages or fraction thereof. Material filmed is not for reproduction without permission of the copyright owner.

For convenience and to keep bookkeeping costs down, a coupon system has been established. Users may buy any quantity of photoduplication coupons at fifty cents each. Order blanks are available upon request. Checks should be made payable to the Treasurer of the United States, and sent to the Army Medical Library, 7th Street and Independence Avenue, S. W., Washington 25, D. C.

(*Continued on page 240*)

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

PSYCHONEUROSIS

Psychogenic diseases are in the limelight today. The problems they created in the induction centers and later in the armed forces aroused and demanded justifiable attention. Their importance in civilian life is no less urgent. Although better understood now than in the past, there is yet much to be explained. The psychiatrists and psychologists, not without exceptions, have stressed the psychologic aspects almost to the exclusion of the physical phase in consideration of etiology whereas other large groups of clinicians have been so fascinated with the findings of purely pathologic lesions as to ignore any other explanations for any bodily complaints. These opinions are now being challenged by many internists and other investigators who believe that practically all diseases have really two components, namely, the mental and the physical. They argue that any condition which affects the body will also involve the mind and vice-versa to a certain intent. This concept is considered to be particularly pertinent in the large group usually classified as the psychoneurotic or psychogenic. They contend that only with a proper evaluation of these two factors will a proper understanding of these disorders be made and any rational attempt at treatment be secured.

Recent physiologic studies have helped substantiate these ideas. It is known that conditions such as emotional disturbances affect the autonomic nervous system resulting in visceral changes in the cardiovascular, gastrointestinal, respiratory or other systems of the body. Various problems relating to the symptoms have been studied and information from different sources has been made available to show definite physiologic changes. Wolf[1] has demonstrated by actual measurements how anxiety, anger and tension lead to inefficient pulmonary ventilation causing dyspnea. The effect of similar emotional stress and strain on blood pressure or coronary vessels producing heart pain has been substantiated. Anxiety states have been reported by Sargent,[2] to be a factor in the production of actual muscular tension and even fibrillary twitchings in a group of soldiers hospitalized for backache. The sugar tolerance curves have been found to be abnormal more frequently in patients with a diagnosis of psychoneurosis than in controls. The results of other investigations along those lines have appeared recently.

In this month's ARCHIVES, Watkins[3] and his associates supply additional original information which is valuable. Their physiologic study is specific and objective. It is this type of scientific approach that will remove false concepts and aid in correcting prejudiced ideas concerning the psychogenic diseases. It is worthy of note that a physiatrist in cooperation with other clinicians contributed his talent and efforts in helping to clarify this most perplexing problem.

1. Wolf, Geo. A., and Wolff, Harold G.: Certain Symptoms Associated with Cardiovascular Disorders, Psychosom. Med. 8:293 (Sept.) 1946.
2. Sargent, Morgan: Psychosomatic Backache, New Eng. J. Med. 234:427, 1946.
3. Watkins, A. L.; Cobb, S.; Finesinger, J. E.; Brazier, Mary A. B.; Shands, H. C., and Pincus, G.: Psychiatric and Physiologic Studies on Fatigue, Arch. Phys. Med. 28:199 (April) 1947.

PHYSICAL MEDICINE MARCHES ON IN TEXAS

Nothing succeeds as well as success. It was a courageous yet timely undertaking when the Medical School of the University of Texas last year announced the holding of a postgraduate course in physical medicine at Galveston in order to stimulate interest in physical medicine in the Southwest. The 1946 course was an outstanding success, due to the working of the medical school group as a perfect team under inspired leadership, the assistance of some invited leaders from the outside and to far-famed Texas hospitality. This year, in the wake of this success, the announcement of a second course on physical medicine and medical rehabilitation for March 3 through 7, 1947 with a galaxy of lectures surpassing that of last year, evoked interest far beyond the originally contemplated limits and the success of this course likewise considerably exceeded that of last year. There were registered over 170 physicians and technicians not only from 35 States of the Union but also from Canada and Switzerland. The list of guest speakers from outside Texas included Lt. Herman J. Bearzy, Cadet and Team Physician, U. S. Military Academy, West Point; Dr. Robert L. Bennett, Professor of Physical Medicine, Emory University Medical School; Dr. Donald A. Covalt, Assistant Medical Director, Medical Rehabilitation and Physical Medicine, Veterans Administration, Washington, D. C.; Dr. Earl C. Elkins, Consultant on Physical Medicine, Mayo Clinic, Rochester, Minn.; Mr. H. J. Holmquest, Lecturer in Applied Physics, Northwestern University Medical School; Dr. Richard Kovács, Professor of Physical Medicine, New York Polyclinic Medical School; Major John H. Kuitert, M.C., Chief of Physical Medicine Service, Fitzsimons General Hospital, Denver; Dr. Kenneth S. Landauer, Director of Medical Care Program, National Foundation for Infantile Paralysis; Dr. Gordon M. Martin, Assistant Professor of Medicine, University of Kansas Hospitals, Kansas City; Dr. Frank R. Ober, Clinical Professor Emeritus, Harvard University Medical School, Boston; Dr. George M. Piersol, Professor of Clinical Medicine, University of Pennsylvania Medical School; Dr. Arthur L. Watkins, Associate in Medicine, Harvard Medical School. They were assisted by speakers from Texas, such as Dr. Ben L. Boynton, Director of Physical Medicine, Shannon West Texas Memorial Hospital, San Angelo, Mr. J. J. Brown, Director Vocational Rehabilitation, State Board for Vocational Education, Austin and Dr. Oscar O. Selke, Jr., Director of Physical Medicine, Hermann Hospital, Houston; as well as by members of the faculty of the University of Texas. Among these were: Truman G. Blocker, Director of Postgraduate Studies; G. W. N. Eggers, Clinical Professor of Orthopedic Surgery; Jack Ewalt, Professor of Neurology and Psychiatry; C. N. Frazier, Professor of Dermatology and Syphilology; Raymond Gregory, Professor of Medicine; Director of Diagnostic Clinic; G. R. Herrmann, Professor of Medicine; C. D. Leake, Vice-President and Dean; Morris Pollard, Assistant Professor of Preventive Medicine; E. J. Poth, Professor of Surgery; Edward Randall, Professor of Therapeutics; Martin Schneider, Associate Professor and Director, Department of Radiology; W. A. Selle, Professor of Physiology; C. T. Stone, Professor of Medicine; Chairman, Department of Internal Medicine and E. M. Winsett, Resident in Pathology.

The program conducted by this impressive team was carried out in the large amphitheater of the out-patient building of the medical school. The first two days were devoted to general topics and methods of treatment as well as to instructional periods by actual demonstration and motion pictures. practice and in the medical specialties and one-half day to medical reha- One-half day was devoted to a symposium of physical medicine in general

rehabilitation. An entire day was given over to a symposium on arthritis and another day to a symposium on poliomyelitis. The material presented at these sessions generally was well balanced between basic information, the essentials of clinical application and results of newer research. The sessions were held before an interested audience in the auditorium filled to capacity; medical students in a group also attended some of the sessions.

The chief planner and driving force of the instruction course was again the tireless Dr. W. A. Selle, professor of physiology and traveling research fellow of the Baruch Committee in Physical Medicine. Dr. Chauncey D. Leake, Vice-President and Dean of the Medical College was again the brilliant and dynamic leader who welcomed the visitors; Mrs. Leake and the gracious wives of members of the faculty, Mrs. Selle, Eggers and Randall assisted in hospitality to visiting speakers and their wives; as a matter of fact a quartet of physiatrists ladies from Rochester, Boston, Kansas City and Warm Springs greatly added to the charm and interest of the social events. The evening programs consisted of a formal dinner at which Dr. Leake presided and Dr. George M. Piersol was principal speaker; another evening Dr. Earl Elkins showed a color movie on rehabilitation of paraplegics and Dr. Richard Kovács presented kodachromes of a "Trip Around the United States." The Southern X-Ray Engineering Company and the Burdick Corporation arranged for a special evening of entertainment and refreshments, while in connection with the other two evening sessions Mr. F. Wilson Ille of New York and Miss Ruby Decker, chief physical therapist of John Sealy Hospital furnished refreshments. The colorful Balinese room jutting out from the famed Sea Wall also entertained many gay parties of visitors.

The second Galveston session adjourned after its four and a half days in high spirits, with its work of instruction well carried out and with the conviction of all participants that there is a definite place for the yearly repetition of postgraduate "institutes" of this sort, not only in hospitable and hustling Texas, but also in many other places where inspired leadership makes use of the wide open opportunity to teach physical medicine and rehabilitation to a medical profession awakened to its inherent values.

ROUND TABLE ON BIOPHYSICS AT MINNEAPOLIS

Readers are requested to submit questions to be discussed at the round table on Biophysics, which is planned as part of the annual session. Please direct your suggestions to Program Committee, American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2.

Medical News

(Continued from page 236)

Experiment in County Home Proves Rehabilitation Value

A few weeks ago the County Commissioners of Allegheny County, Pa., were nonplussed when several residents of the county who were obviously not indigent began to request permission for admittance to Woodville, the County Home, eight miles from Pittsburgh. As the story developed, however, the officials learned that the applicants had heard of a small rehabilitation program recently instituted at Woodville, which is bringing to its indigent occupants new hope and opportunities which are not available elsewhere in the community.

The success of this small rehabilitation program in a county institution is especially significant in that the great majority of the cases aided there were in the older age groups. Since 1900 the proportion of our nation's population over age 65 has increased by 35 per cent.

Economic productivity is usually considered the final objective of rehabilitation. The social and economic values of rehabilitation, however, cannot be measured by this yardstick alone. A steadily mounting number of people are passing the age where full employment for many is doubtful. The experience at the Allegheny County Home has shown, however, that many can gain increased dignity and self-respect through ability to take care of themselves, and can be taught to do some gainful work. This means also a consequent lessening of the burden which they of necessity place upon society.—Rusk, N. Y. *Times.*

Medical Bills Introduced in State Legislation

Connecticut. — H. 551, to amend the law relating to the practice of osteopathy proposes to require certification by the board of healing arts of osteopathic national board diplomates applying for a license without examination. H. 553, relating to the practice of osteopathy, would require applicants for a license by reciprocity to meet the requirements of the state board of healing arts before being granted a license without examination. H. 552, is to amend the law relating to naturopathy, proposes, among other things, to provide that a person who has been refused a certificate by the state board of healing arts does not qualify for a license without examination by the board of naturopathic examiners. H. 705, to amend the law relating to chiropractic, proposes that no person who has been refused a certificate by the state board of healing arts may qualify for a license without examination by the board of chiropractic examiners.**

Maryland. — H. 52, to amend the medical practice act, proposes to exempt therefrom persons treating human ills in accordance with the tenets of Christian science. H. 69 proposes the creation of a state board of physical therapy examiners and defines physical therapy as "the treatment of human injuries, diseases or disabilities by means of the healing properties of massage, ultraviolet rays, mechanical devices, heat, cold, air, light, water and electricity, but not by means of roentgen rays, radium, surgery or drugs." The proposal also states that a physical therapist is one who treats only patients diagnosed and referred by licensed medical doctors.*

New Mexico. — S. 115 proposes the creation of a state board of naturopathic examiners and defines naturopathy as follows: "The term 'Naturopathy' as used herein shall comprehend, embrace and be composed of the following named acts, practices and usages, as set forth in the Act of Congress of the United States, enacted February 7, 1931, H. R. 12169 defining Naturopathy. Diagnosis, and Practice of physiological and mechanotherapy, articular manipulation, corrective orthomaterial sciences of healing as follows: The physiological and mechanical sciences such as pedic gymnastics, neurotherapy, psychotherapy, hydrotherapy, phototherapy, chromotherapy, vibrotherapy, thalmotherapy, and dietetics which shall include the use of foods of such biochemical tissue-building products and cell salts as are found in the normal body; and the use of vegetal oils and dehydrated and pulverized fruits, flowers, seeds, barks, herbs, roots and vegetables uncompounded and in their natural state." **

Washington. — S. 193 proposes the creation of a sanipractic physicians' examining board and defines sanipractice as "the science and art of applied-prophylactic and therapeutic sanitation, which enables the physician to direct, advise, prescribe or apply food, water, roots, herbs, light, heat, exercises active and passive, manipulation, adjusting tissue, vital organs or anatomical structure by manual, mechanical or electrical instruments or appliances; or other natural agency, to assist nature restore a psychological and physiological interfunction for the purpose of maintaining a normal state of health in mind and body." **

Wisconsin. — A. 161 proposes the appointment of a board of examiners in naturopathy and defines naturopathy as "the prevention, diagnosis and treatment of human injuries, ailments and diseases by means of any one or more of the material methods or agencies of healing as taught by approved schools of naturopathy, said methods or agencies including dietetics, phytotherapy, vitamin or mineral or glandular food supplementations, irrigations, inhalations, external applications, physiotherapy and electrotherapy. The practice of naturopathy shall exclude the practice of medicine, surgery, obstetrics, osteopathy, chiropractic and the use of drugs. The practice of naturopathy shall exclude the treatment of cancer, tuberculosis, gonorrhea, syphilis, diphtheria, scarlet fever, typhoid fever, smallpox and fracture." *

* Rep. J. A. M. A. 133:328 (Feb. 1) 1947.
** Rep. J. A. M. A. 133:633 (Mar. 1) 1947.

New Center for Cerebral Palsy

The Cerebral Palsy Treatment and Training Center, 150th Street and St. Nicholas Place, which was opened January 17, is the first such center in the metropolitan area of New York City. Pediatric Foundation, the center will have a staff of physicians and therapists who will examine and treat cases and seek their causes.

New Foundation for Research on Hypertension

A gift of $1,000,000 to Beth Israel Hospital, New York City, for a new foundation for medical research on hypertension has been established by Mr. and Mrs. Joseph Levy and will be known as the "Joseph and Helen Yeamans Levy Foundation, established in memory of their daughter Miriam Levy Finn." Dr. Arthur M. Fishberg, Beth Israel physician in chief and director of medical service, will serve the foundation as director. One objective of the foundation will be to furnish opportunities to young physicians and scientists.

Veterans Administration

The second conference on physical medicine and medical rehabilitation sponsored by Branch Office No. 3, Phiadelphia, was held Jan. 27 to Feb. 1 at the Veterans Administration Hospital, Aspinwall, Pa. Members of the American Congress of Physical Medicine who participated in a well rounded program were, Drs. C. G. Psaki, H. R. Lipscomb, M. Ferderber, and S. Machover.

The VA has established seven paraplegic centers in hospitals strategically located from coast to coast. These centers, especially designed to treat veterans with spinal cord injuries which result in partial or complete paralysis of the body, are located at Framingham, Mass.; Memphis, Tenn.; Van Nuys, Calif.; Staten Island, N. Y.; Richmond, Va.; Bronx, N. Y., and Hines, Chicago, Ill. VA has approximately 1,200 veteran-patients suffering from injuries to the spinal cord. This number is expected to reach about 2,000, eventually.

Nearly 18,500 veterans with certain disabilities have applied for automotive conveyances at Government expense, with 13,300 certified as eligible.

The number of veterans hospitalized by Veterans Administration reached a new all-time high on Jan. 22. VA reported that a total of 119,845 veterans were receiving treatment in VA hospitals and homes and in non-VA hospitals under contract to VA on that date.

VA's load of veteran-patients has been increasing steadily. A year ago, 92,276 veterans were hospitalized by VA and six months ago, 99,509. Of the nearly 120,000 patients under VA care on Jan. 22, a total of 90,470 were in VA hospitals; 15,298, in VA homes, and 14,077, in non-VA hospitals.

While the number of veterans hospitalized has been increasing, the number awaiting hospitalization has been declining. On Jan. 1, only 22,385 veterans with nonservice-connected disabilities were awaiting VA hospitalization, the smallest number since March, 1946. The drop was attributed to an increase in the number of beds available in VA hospitals and homes and to a more rapid turn-over of patients because of improved medical treatment.

The number of applications on file for hospital and domiciliary care also dropped during December to 63,387, a new low since June, 1946. The decrease probably was caused by veterans delaying their applications for treatment until after the Christmas holidays, rather than to a drop in the number in need of medical attention.

Veterans with service-connected ailments are given top priority for VA hospitalization, but veterans with nonservice-connected disorders are hospitalized only when beds are available and if they say they cannot afford treatment in other institutions.

Dr. Barger Takes New Post

Dr. G. J. P. Barger will be in charge of Physical Medicine in the new Yater Clinic recently opened in Washington, D. C.

Amputee Clinic

A month long amputee clinic was held at Hasbrouck Heights Hospital, New Jersey, under the direction of Dr. Henry H. Kessler, Newark. More than 200 orthopedic surgeons, mostly from New York, New Jersey and neighboring states, as well as artificial limb manufacturers and persons who have undergone amputations took part. Dr. Kessler hopes to bring the benefits of army and navy wartime research on amputation to the civilians in this country who have lost arms and legs. While there were 17,000 service men who suffered amputations during the war, the number of civilians who lost limbs during the same period is 120,000, Dr. Kessler said. His program covered five points: Patients should be shown by demonstration what their abilities will be with an artificial limb; there should be close cooperation between artificial limb design and the surgical types of amputations performed; medical supervision of the stump should be continued until the artificial limb is properly fitted; design of the artificial limb should be suited to the occupation the patient expects to perform as well as to his general build; the patient should be educated at the hospital in the use of the artificial limb and its capabilities.

National Hospital for Speech Disorders

The National Hospital for Speech Disorders, the only medical-educational institution in the United States devoted solely to the diagnosis and treatment of speech and voice disorders is approved for veteran education and rehabilitation. The hospital also treats veterans with service-incurred or service-aggravated speech disorders under the Veterans Administration's medical re-

habilitation program. The hospital is located at 61-63 Irving Place, New York 3, and further information may be obtained by writing the Medical Director, James S. Greene, M.D.

Dr. Titus at Coatesville

Dr. Norman E. Titus writes that he has been appointed Physician in Charge, Medical Rehabilitation Division, Veterans Administration Hospital, Coatesville, Pa.

Meeting of the National Cerebral Palsy Medical Advisory Council

The National Cerebral Palsy Medical Advisory Council of the National Society for Crippled Children and Adults met in Chicago to provide professional medical guidance in developing the nation wide program for the "more than 400,000 cerebral palsied or brain-injured persons in the nation."

Dr. Winthdop M. Phelps, Director, Children's Rehabilitation Institute, Cockeysville, Md., is Chairman of the National Cerebral Palsy Medical Advisory Council. Members of the Council attending the Chicago meeting were: Dr. Earl R. Carlson, Lago del Mare School, East Hampton, N. Y. and Pompano, Fla.; Dr. George G. Deaver, Professor of Medicine, New York University, N. Y.; Dr. Temple Fay, Director of Neuro-Physical Rehabilitation Clinic, Philadelphia; Dr. Meyer A. Perlstein, Chairman Medical Advisory Board, Michael Reese Nursery School, Chicago; and Dr. Bronson Crothers, Children's Memorial Hospital, Boston, Mass.

Dr. L. Newman to Northwestern

Dr. Louis B. Newman, Chief, Medical Rehabilitation Service, Veterans Administration Hospital, Hines, Illinois, has been appointed on the faculty at Northwestern University Medical School in the Department of Physical Medicine.

Campaign for Trained Occupational Therapists

The American Occupational Therapy Association is distributing "Occupational Therapy, A Pioneering Profession" to doctors, educators, public health officials, rehabilitation agencies, vocational counselors and others in a campaign to increase the ranks of trained occupational therapists. This drive spearheads the thirtieth anniversary of the American Occupational Therapy Association, which has worked to establish standards of training and qualification by engaging in research and spreading information concerning the use of occupational therapy as an adjunct of medicine. Registered occupational therapists now number 2,200, which is far short of the nation's demand for trained personnel.

Department of Industrial Medicine

A department of industrial medicine and training course for medical graduates covering all phases of industrial medicine is to be established at Woodward General Hospital, Detroit. It is intended to train doctors for service with the medical division of both large and small industrial plants. More than $400,000 has been collected toward building the $2,500,000 hospital to be built at Thirteen Mile Road near Woodward Avenue. Wayne University is collaborating with the advisory board of Woodward General Hospital medical staff in setting up the department and training staff.

Hearings on Medical Service Corps Bill

It is proposed to establish in the Medical Department of the Regular Army a Medical Service Corps with a Reserve component which will be composed of pharmacists, sanitary engineers, optometrists, psychologists, bacteriologists, business administrators and officers of similar skill, all of whom have served with the Medical Department. Experience during World War II demonstrated the advisability of including these scientific and highly trained specialists of the Medical Department in a single corps.

General Kirk Receives Honorary Degree

Major Gen. Norman T. Kirk, The Surgeon General, and other military leaders were awarded the honorary degree of Doctor of Laws by Columbia University at a special ceremony in New York, February 21.

Name of Medical School Changed

The Surgeon General of the Army has announced establishment of the name Army Medical Department Research and Graduate School. This school, which was formerly known as the Medical Department Professional Service Schools, will continue to be a part of the Army Medical Center. The Army Medical School, which is a part of this research and training center, was established in 1893 and has long been a source of important contributions to medical advancement.

200,000 Americans Are Potentially Unemployable Each Year Through Disablement

Mrs. Walter Bloedorn, chairman of the fund advisory committee, Washington Committee for Civilian Rehabilitation, stated modern medicine and rehabilitation agencies are neglecting 200,000 Americans each year who become potentially permanently unemployed through disablement.

National Council on Rehabilitation

The annual meeting of the National Council on Rehabilitation, scheduled for April 29 and 30, has been planned in cooperation with the National Rehabilitation Association, whose annual meeting will follow immediately on May 1-3. Both meetings will be held in the Jefferson Hotel, St. Louis.

Obituary

We regret to announce the passing of two of our Congress members, Dr. Aubrey Parsons of Cleveland, Ohio and Dr. Andrew J. Brown of Crystal Springs, Miss.

BOOK REVIEWS

X-RAYS AND RADIUM IN THE TREATMENT OF DISEASES OF THE SKIN. By *George M. MacKee,* M.D., Professor of Clinical Dermatology and Director of Department of Dermatology (Skin and Cancer Unit), New York Post-Graduate Medical School and Hospital, Columbia University; and *Anthony C. Cipollaro,* M.D., Assistant Professor of Dermatology and Assistant Director of Department of Dermatology (Skin and Cancer Unit), New York Post-Graduate Medical School and Hospital, Columbia University. Contributor, *Hamilton Montgomery,* M.D., Associate Professor of Dermatology, Mayo Foundation for Medical Education and Research, Graduate School, University of Minnesota, Rochester, Minnesota. Fabrikoid, Price, $10.00. Pp. 668. Fourth Edition. Philadelphia: Lea & Febiger, 1946.

X-rays constitute at present the most important single therapeutic agent in the armamentarium of the dermatologist. X-rays and radium are dangerous agents in unskilled hands: the physician who uses them should be a capable dermatologist and dermatoradiologist with modern knowledge and adequate equipment. He should know the nature, biologic action, therapeutic effect and technic of x-rays and radium before he attempts to employ these agents. McKee and Cipollaro's latest edition again effectively correlates the specialized knowledge of the dermatologist and radiologist. It includes the essential elements of biology and physics, such as passage of radiations through matter, definitions of quantity and quality of radiation, physical factors affecting quantity and quality of radiation, methods of measuring quantity of radiation, tissue dosage, the time intensity factor and tissue recuperation. Several chapters pertain to details of technic: Arithmetical computation of X-ray dosage, practical X-ray technic for the beginner, filtered X-ray technic, roentgen therapy with extreme long wave lengths, biologic and biochemical effects of radiation, effect of roentgen rays and radium on normal animal organs and tissues, action of X-rays and radium on pathologic tissue and clinical effect of roentgen rays and radium rays on the skin.

The larger half of the book presents the detailed consideration of skin conditions which are treated more or less successfully with X-rays and radium. A well written chapter on medicolegal aspects ends this conservative and well illustrated text. The authors point out repeatedly that the dermatologist who places too much reliance on roentgen therapy is assuming an attitude inimical to the future of this specialty. The essential requisite is an adequate training in every phase of cutaneous medicine. This should include a knowledge of the basic medical sciences, laboratory methods, cutaneous diagnosis and therapy, syphilology and physical therapy. Every physician seeking authoritative information as to present day status of the uses of X-rays and radium in skin conditions and wishing to avoid many possible pitfalls will find this volume invaluable.

EARLY AMBULATION AND RELATED PROCEDURES IN SURGICAL MANAGEMENT. By *Daniel J. Leithauser,* M.D., F.A.C.S. Chief of Surgery, St. Joseph Mercy Hospital, Detroit, Mich. Cloth. Price, $4.50. Pp. 220, with 36 illustrations. Springfield, Ill.: Charles C. Thomas, Publisher, 1946.

Ten years ago very few publishers would have the courage to publish a book setting forth these ideas. However, as early as 1899 an article by Emil Ries appeared in the *Journal of the American Medical Association* on a "radical change" (early ambulation) in the postoperative care of patients. Reports have appeared repeatedly since then advocating early ambulation according to the information contained in the chapter on the history of this procedure which is interestingly brought out in this book.

Several chapters consider the physiologic benefit of early rising postoperatively for patients and include the discussion of the prevention of the pulmonary, circulatory, gastrointestinal, nutritional, wound and other complications. The chapter on surgical technic is important particularly concerning the incisions for the various operative fields, the application and types of suture material, the care and handling of tissues and organs during the operation and other factors which make early ambulation a possibility according to the author.

The author's style of writing may antagonize rather than convert. It is that of a salesman who attempts to oversell his product. As an example, a non-believer in early ambulation might have reason to doubt the method when the author cites as the only contraindications "profound shock when the patient is practically pulseless, an uncontrolled internal hemorrhage and when the patient's condition is believed hopeless." The impression is created that any surgeeon who does not have the patient out of bed according to the plan is guilty of malpractice, or any nurse who shows the least apprehension about early rising is to be considered most uncooperative and if a patient questions the procedure he is threatened with "blood clots in the legs," pneumonia or distention." This belligerency hardly seems necessary in a procedure that has much rationale and has been proven beneficial as is shown by the author's series of 2,047 operative cases. The results have been spectacular.

The volume should be of interest to physiatrists and others working in physical medicine.

ELEMENTS OF GENETICS. By *Edward C. Colin,* Ph.D., Chicago Teachers College. Second Edition. Price, $3.50. Pp. 402. Philadelphia and Toronto: The Blakiston Co., 1946.

In the history of man's progress toward an understanding of the laws of nature, no story has higher dramatic interest than that of the discovery of the laws of heredity. This story centers about the life of a great man, Gregor Johann Mendel, born in a village of the Sudeten region of Silesia, at that time a part of the Austro-Hungarian Empire. Mendel, during his own researches became a thorough student of Darwin's work, but did not accept Darwin's theories as adequate, although he was not opposed to evolution. And, interestingly enough, the very field in which Darwin's theories later proved to be inadequate (the field of heredity) is the one in which Mendel made his own great contribution. This book gives special emphasis on the application of the principles of the Mendelian heredity to man and the roles played by heredity and environment to man. Consideration of the effects of environment and training in correcting physical handicaps and improvement of performance is given. While this volume is principally a textbook for college students in biology and taking lecture and laboratory courses in genetics it should be of interest to every progressive physician especially by the inclusion of many pertinent data about human blood groups, the Rh factor and the full discussion of heredity in man. The interest and effectiveness of the book have been greatly enhanced by 90 illustrations and many diagrams and tables carefully selected to illuminate some particular points.

IF YOU ASK MY ADVICE. By *Henry Pleasants,* Jr., M.D. Cloth. Price, $2.00. Pp. 110. Boston: Bruce Humphries, Inc., 1946.

Eight articles on family problems written by a general practitioner. The first chapter insanity in the family, sets the example of the author's method of presenting the articles; no attempt to frighten the reader, no strained effort to be humerous, no "writing down" to the layman, or no build up for the author as a great doctor—instead just good common sense. Other chapters such as "This Thing Called Sex," and "The Alcoholic" are particularly good. It is refreshing to find a book written by a professional man for the layman which is not an insult to their intelligence. This work is entitled to popularity.

HEALTH FROM THE GROUND UP. By *Karl B. Mickey,* Public Relations Dept., International Harvester Co. Cloth. No charge. Pp. 122. Chicago: International Harvester Co., 1946.

A short non-scientific presentation intended for the laymen on the importance of soil on nutrition. Although the farmer will probably be more critical in the discussion of soil's fertility, erosion, exhaustion, etc., the booklet should have general appeal since the problem affects everyone. The author shows the influence of the soil's composition and how its exploitation will concern mankind. Many of his ideas are sound and thought provoking.

THE CONTROL OF VENEREAL DISEASE. By *R. A. Vonderlehr,* M.D., Director, District No. 6, U. S. Public Health Service; and *J. R. Heller,* Jr., M.D., Chief, Venereal Disease Division, U. S. Public Health Service. With a foreword by *Thomas Parran, M.D.,* Surgeon General, U. S. Public Health Service. Fabrikoid, Price, $2.75. Pp. 246. New York: Reynal & Hitchcock, 1946.

This is a comprehensive and forthright study on the history of venereal disease and its control in America and the American armed forces during the war years. It is an extremely honest estimate of both the debit and credit sides of that history; the increased promiscuity, particularly among juveniles, with its resultant increase in the possibilities of venereal infection, that seems a concomitant of war; the frequent bungling of Army and Navy control measures; and then, on the other side, the improved methods of clinical treatment, the new and more effective drugs, the greater public recognition of venereal disease as a civic problem. Among the 15 chapters of the book the one on prostitution contains the interesting account of "Dr." Anna Swift, licensed physiotherapist and masseuse of New York whose "Danish Institute" elaborately equipped with apparatus was one of the most elaborate brothels of the city. No two men in the public health profession are more competent to make this report than the authors. Each in succession has been chief of the Venereal Disease Division of the United States Public Health Service during the most critical years of its existence. The war experience makes clear that more individual and community action must be directed against the moral, social and economic roots of prostitution and promiscuity. Research into the psychologic causes is needed, also, no less than in diagnosis and therapeutics. Every thinking citizen interested in the welfare of this country and in the problems of public health and popular education should read this forceful and detailed account of one of the greatest moral and health problems.

GENERAL BIOLOGY AND PHILOSOPHY OF ORGANISM. By *Ralph Stayner Lillie.* Professor Emeritus of General Physiology, University of Chicago. Cloth. Pp. 215. Price, $3.00. Chicago: The University of Chicago Press, 1945.

In this interesting book the author as a biologist attempts a synthesis of biological and philosophic views of reality. He discusses at length the "psychophysical unity" of the organism, and points out that psychic factors in living organisms represent a novel feature different from the sum of the parts of the organism in the same sense that any chemical compound has novel "imergent" features not present in the sum of the elements combined. Then in discussing evolutionary processes he discusses the ways in which the psychic elements of the organism affect these processes by supplying directive and teleological influences

which tend to produce higher forms of organization.

By the nature of the subject matter the book is sometimes difficult to follow. It is written in a clear and lucid manner and tightly argued throughout.

THE EYE MANIFESTATIONS OF INTERNAL DISEASES. By *I. S. Tassman*, M.D., Associate Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania, Philadelphia; Attending Surgeon, Wills Hospital, Philadelphia. Cloth. Price, $10.00. Pp. 614, with 243 illustrations. Second edition. St. Louis: The C. V. Mosby Company, 1946.

This book has gained for itself an excellent reputation in the four years after it was first published. The second edition contains some additions which increase its value. The general plan of the book has been maintained. The first five chapters seem to be of an introductory nature. Anatomy, general pathology and methods of examination are discussed. In each of the succeeding chapters there is the discussion of the ocular symptoms of one group of diseases. The book is extremely valuable for those general practitioners and specialists in other fields who want to have a clear understanding of the ocular symptoms in a particular case. New additions to the second edition include Ocular allergy, epidemic Keratoconjunctivitis, Hurler's disease, Osteoporosis, Lymphogranuloma venereum, Bowen's disease of the cornea, Toxoplasmic Encephalomyelitis and Purtscher's disease. The effects of physical agents applied to the eye are briefly discussed.

SURGICAL TREATMENT OF SOFT TISSUES. Supervising Editor, *Frederic W. Bancroft*, A.B., M.D., F.A.C.S., Associate Clinical Professor of Surgery, Columbia University, College of Physicians and Surgeons; Attending Surgeon, New York City and Beth David Hospitals; Consulting Surgeon, Veterans Administration, Lincoln and Harlem Hospitals, New York; Kings Park State Hospital, Kings Park, New York. Associate Editor, *George H. Humphreys*, II, A. B., M.D., Sc.D., F.A.C.S. *Valentine Mott*, Professor of Surgery, Columbia University, College of Physicians and Surgeons, and Director of Surgical Service, The Presbyterian Hospital, New York. Pp 520 with 244 illustrations. Cloth. Price, $15.00. Philadelphia: J. B. Lippincott Company, 1946.

This well illustrated text covers in scope the treatment of some soft tissue lesions commonly managed by the general surgeon. As the preface states the term "soft tissue" is somewhat ambiguous. This is evident since the table of contents omits on the whole the soft issue lesions of the surgical specialties. Also absent are the common lesions of the abdomen and the neck as well as others. Numerous well known contributing authors vary in the strictness with which they have limited their discussions to "treatment"; but digressions from pure treatment where used are desirable rather than objectionable. The material is modern. Adequate bibliographies are included at the end of the various sections. For those lesions included, this volume occupies an intermediate position between the usual textbook of surgery and the more exhaustive treatises on surgical therapy. As such the book should be of particular interest and value to the advanced medical student whose interest runs to surgery and to the surgical house officer. Unfortunately, the price will probably prohibit its wide purchase by these two groups.

THE NERVOUS CHILD. By *Hector Charles Cameron*, M.A., M.D. (Cantab.), F.R.C.P. (Lond.). Consulting Physician to the Children's Department, Guy's Hospital. Fifth Edition. Cloth. Price, $3.00. Pp. 240, with 8 plates. London, New York, Toronto: Geoffrey Cumberlage, Oxford University Press, 1946.

The first edition of this book appeared in 1919. The present edition has a few additions and alterations but in the main follows the original idea, namely to discuss the functional disorders of infancy and childhood. As a practitioner and observer of children for many years the author has become convinced that "nervous disturbance is erected upon a physical basis. Certainly the child himself does not readily submit to a corresponding cleavage of mind from body and of his disorders many are disturbances of both." This quotation is from the preface and is the predominating theme for the book.

Chapters on "Want of Sleep," "Management and Conduct," "Doctors, Mothers and Children," "Nervousness and Physique," "Eneuresis" and others present sound advise to parents and doctors. Most of the book can be readily understood by the layman. The problems considered are those encountered in every family and the sound advise given should be most helpful. The occasional reference to the nurse who takes the child for a walk in the country, or who puts the child to bed or who does all the other things a nurse used to do is reminiscent of by gone days which certainly applies to this country and from all indications to England as well.

TECHNIC OF PSYCHOANALYTIC THERAPY. By *Sandor Lorand*, M.D., Member of the Faculty of the New York Psychoanalytic Institute, Formerly Director of the Mental Health Clinic, Mount Sinai Hospital, Formerly Lecturer Columbia University. Cloth. Price, $3.50. Pp. 232. New York: International Universities Press, 1946.

To the psychoanalytically minded, especially the Freudians, this work may seem worth while but to the others it will be balderdash; as has been said, "different tastes render different verdicts." According to the author's preface the book is a compilation of the seminar given at New York. Advice and training for the analyst are given—"he should know what he is doing and why." Lengthy case reports are used to illustrate the difficulties in analysis.

The publisher has used unusually large type and pages 153-168 are found after page 184.

ADVANCING FRONTS IN CHEMISTRY. Volume II Chemotherapy. Edited by *Wendell H. Powers,* Assistant Professor of Chemistry, Wayne University. Contributors: William H. Feldman, Frederick F. Blicke, E. H. Northey, Harry S. Mosher, C. Kenneth Banks, and Willard H. Wright. Cloth. Pp. 156. Price, $3.50. New York: Reinhold Publishing Corporation, 1946.

This book represents a symposium on chemotherapy given at Wayne University in 1945. It consists of a series of lectures by outstanding men who are engaged in research at the present time, thus presenting the latest information on these problems. The subjects discussed include chemotherapy in tuberculosis, malaria and other parasitic diseases as well as the chemistry of the sulfa drugs, synthetic antispasmodics and organometallic compounds. Each lecture can be considered as a brief monograph of limited scope which will be found valuable to physicians not actively engaged in research in these fields who wish to learn the up-to-date status of chemotherapy. The necessary chemical background to understand the problems involved is provided. These lectures thus constitute an excellent postgraduate course and also will be valuable reading for the medical student.

THE PRINCIPLES OF ANATOMY. By *A. A. Abbie,* M.D., B.S., D.Sc. (Syd.), Ph.D. (Lond.), Elder Professor of Anatomy and Histology in the University of Adelaide. Second edition. Cloth. Pp. 273, with 76 diagrams. Price, 12s. 6d. Sydney and London: Angus and Robertson, Ltd., 1946.

The aim of this book is to provide a text for the beginner in human anatomy who has had no previous background of study in biology. Accordingly function is considered simultaneously with structure. Introductory chapters serve largely as a dictionary for biological language. As far as anatomical details are concerned the skeletal system is elaborated more than others. It is perhaps doubtful if this method of teaching anatomy is applicable to medical students, but such a text should serve a useful purpose in courses for nurses, physical therapists and occupational therapists as a substitute for courses in biology. It provides an excellent background for later courses in the details of anatomy and kinesiology.

PHYSICAL MEDICINE ABSTRACTS

Physical Rehabilitation in Civilian Practice. Frank H. Krusen.

West Virginia M. J. **42**:313 (Dec.) 1946.

There is need for community rehabilitation services and centers to provide the necessary care and rehabilitation for the estimated 23,000,000 persons in the United States who are handicapped because of disease, injury, maladjustment or former wars. The following examples indicate graphically the need for the expansion of physical rehabilitation throughout the United States.

In 1940 there were 6,500,000 disabled males between the ages of 15 and 64 years in the United States. In World War II there were approximately 17,000 amputations in the Army. During the same period there were 120,000 major amputations in our civilian population, made necessary by disease and accident. The Office of Vocational Rehabilitation has demonstrated the economic rewards of rehabilitation. Of the 43,997 persons who received vocational or physical rehabilitation under this agency in 1944, 22 per cent, or more than 10,000, never had been gainfully employed, and nearly 90 per cent, or nearly 40,000, had not been employed at the time they started their rehabilitation. During the war 83 per cent of our nation's industries employed handicapped workers. It has been estimated by experts in the field of rehabilitation and re-training that up to 97 per cent of all handicapped persons can be rehabilitated to the extent of gainful employment.

Symposium. A Few Remarks on Rehabilitation with the Presentation of a Model Community Service and Center. A. R. Shands.

Nebraska M. J. **31**:480 (Dec.) 1946.

No phase of medical care has become of greater importance during the period of this war emergency than the rehabilitation of the sick and wounded.

The opinion has been expressed that at least a majority of the veterans who are 100 per cent disabled can be rehabilitated to a point of being employable with good selective placement. Further, it has been stated that up to 97 per cent of all handicapped persons can be rehabilitated to the extent of gainful employment. It should be pointed out that in rehabilitation, the transformation of the physically handicapped individual into a useful, self-supporting citizen with a good social and economic adjustment is not a chance happening, but the result of a careful plan which includes the active cooperation of many members of a reconstruction team.

After the survey and evaluation of a com-

munity's resources, the decision regarding the type of rehabilitation service which can be established should be made. If the needs are large, a rehabilitation center building should be considered. If it is small, the service may be administered through the hospital, the community health center or another local agency. A small start will quickly grow and will soon prove its worth to the community.

Complete Forward Dislocation of the Elbow-Joint. R. Salisbury Woods.

Clin. J. 75:216 (Nov.-Dec.) 1946.

Of the various types of dislocation at the elbow-joint, that of the whole forearm backwards is the most common, while those of displacement to either side are far less frequently encountered. Forward dislocation is very rarely met at all, and so the following case is recorded:

At first reduction was attempted by Bohler's method of traction on the extended elbow. But after three successive attempts, exerting all my weight and strength against the counter-traction of two African nursing orderlies for five minutes at each effort, I decided this would not avail, however long continued. It remained, therefore, to make further trial with the elbow flexed, an assistant gripping the hand and maintaining powerful traction, as for the reduction of a Colles' fracture, while I endeavored to manipulate the forward displacement of ulna and radius downwards and backwards. Even this was difficult, but after two minutes extremely hard work the dislocated bones suddenly slipped into position. the articular surface (coronoid fossa) of the ulna "snapping home" with a palpable click.

The accompanying trauma of the soft tissues resulted in the usual severe extravasation, with about two inches of edematous swelling of the arm, elbow region, and forearm. This was treated by light stroking massage, gentle active movements from the next day, and support in a sling Easy natural function was encouraged by allowing the patient to use the injured limb for dressing and feeding himself.

Physiological Rest. With Special Reference to Arthritis and Nerve Lesions and to the Manufacture of Appliances. Norman Capener.

Brit. M. J. 4481:761 (Nov. 23) 1946.

Physiologic rest is a controlled process, giving immobolization, while safeguarding functional restoration, of a part or the whole of the body in the position most favorable for the biologic processes of growth and repair to the maximum extent required for these processes in the particular disease or injury being treated. Physiologic rest is not necessarily absolute or uninterrupted rest, though for some period it may be so. Its purposes are to promote healing by reducing the local physiologic demands of the limb, by avoiding the aggravation of pathologic processes and by bringing to bear on the lesion the whole general metabolic resources of the patient.

It must be arranged so as to prevent the deforming influence of uncontrolled or unbalanced muscular activity, of muscular atrophy and of gravity. Relaxation and restriction of muscular activity is modulated according to the disease. In some conditions rest will alternate rhythmically with movement, the relation of one to the other varying inversely as healing proceeds. While pathologic conditions are being relieved by rest, no extrinsic pathologic factors should be introduced. Local treatment must be planned within the most favorable general background for physical and psychologic health.

In discussing the present-day change in orientation on the therapeutic use of rest the author has attempted to define the conception of Hilton's term "physiological rest." He has emphasized Thomas' teaching that the surgeon must know how to apply rest physiologically and must also have an intimate knowledge of splint construction and management. In describing a few methods and appliances used in arthritis and nerve lesions the author has tried to show some of the difficulties and to indicate the general lines for future research and practical improvement. Apart from improved design and materials, the cooperation of regional surgical workshops (with some measure of standardization) should lead to greater economy and efficiency as well as comfort for the patient. The amount of standardization need not thwart enterprise or originality.

Those of us who consider improvements in design should maintain an attitude of humility. The human form has not altered during the past hundred years. Before the modern advancement of surgical technic many great minds had devoted themselves to this subject. Study of the old masters (Bonnet in particular) reveals how far they had got. Most "new" ideas have been thought of before. Advance chiefly will come in the utilization of new manufacturing processes and new materials.

Galvanism for Denervated Voluntary Muscles.

Annot. Brit. M. J. 4481:779 (Nov. 23) 1946.

It is well known that muscle atrophy begins soon after denervation and that associated with it is fibrosis of the affected muscles. Guttmann and Guttmann have shown by animal experiments that galvanism can prevent wasting after denervation provided it is applied soon. Although it is impossible to prevent the atrophy that occurs in the first few weeks after denervation, the muscle fibers remain large and interstitial fibrosis is reduced to a minimum in treated muscle. Furthermore, if re-innervation takes place the maximum functional recovery ensues. If on the other hand the denervated muscles receive no treatment the individual fibers shrink rapidly, fibrosis occurs to a much greater extent than it does in treated muscle, and even after re-innervation the functional recovery may be bad.

Stimulation should be started as soon as possible after denervation even if this involves cutting windows in plaster casts to gain access to areas where it can be applied. Galvanic stimuli should be administered ninety times daily at the rate of thirty

per minute, with an interval of one minute between each group of thirty stimuli to permit recovery from any possible muscle fatigue; and this treatment should be applied at least six days a week. For smaller muscles such as those of the hand the value of such measures is not in doubt; where large muscle masses such as those of the thigh are involved tolerable doses of galvanism may affect only the more superficial fibers, and this form of therapy will not be so effective.

Diagnosis and Treatment of Localized Infections in the Hand. William H. Requarth.

U. S. Nav. M. Bull. **46**:1354 (Sept.) 1946.

Later care consists in soaking the extremity once or twice daily in warm, soapy water, keeping the wound clean and carefully debrided, dried in sunlight or under the electric light and finally dressed with sterile gauze and splinted. If the wound contains debris or a necrotic eschar which does not separate, Dakin's solution is useful.

Each dressing should be changed solely by the use of sterile instruments and great care used not to add bacteria from without nor to contaminate the fingers. After observing these precautions, it is certainly illogical to advise the patient to go home and soak the hand, dressing and all, yet this advice is frequently given.

It must constantly be borne in mind that the purpose of all treatment is restoration of function. At each soaking, the hand and fingers should be moved through the greatest range of motion that does not cause pain. During the course of the infection when immobilization is required, it should be in the "position of function," wrist dorsi flexed, fingers flexed, and thumb abducted from the palm. This position allows the greatest function in the event all mobility is lost.

Finally, active motion is more effective than passive motion and the patient must be made to realize that in the last analysis, it will be he alone, through his own diligent massage and exercise, who dictates the final result.

Fibrositis. William Tegner.

Practitioner **157**:446 (Dec.) 1946.

In acute fibrositis a speedy and effective therapeutic procedure is desirable, not only to relieve the sufferer but also to prevent the condition becoming chronic. Rest, heat and analgesics alone are often effective, but traditionally massage is added to these to hasten the process of recovery. Such treatment is physiologically sound in that rest relieves the pain, heat increases the local circulation and aids in the absorption of exudates and also soothes the pain, whilst massage mechanically squeezes on the exudates and prevents the laying down of fresh fibrous tissue. Such treatment, however, has the disadvantage of taking time and of being expensive if a physiotherapist is employed. Thus rest, analgesics and the domestic forms of heat, such as the hot-water bottle, are often employed with considerable success.

In chronic fibrositis satisfactory treatment may often demand considerable perseverance and patience, both from the sufferer and from the physician. It must be stressed that cases of chronic fibrositis which clear up quickly under treatment are the exception rather than the rule; the prescription of one short course of physical therapy may well be useless and disappointing and it should be made clear to the patient that the restoration of normal painless function will take time. Physical therapy has a traditional and accepted place in the treatment of chronic fibrositis. It is most commonly prescribed in the form of heat and massage; to this, active movement should be added in every case.

Pathologic Intervertebral Disk and Its Consequences: Cause and Treatment of Chronic Pain Low in Back and Subject of Herniating Intervertebral Disk. O. R. Hyndman.

Arch. Surg. **53**:247 (Sept.) 1946.

Hyndman presents evidence that degeneration and distintegration of intervertebral disk in the low lumbar region is the predominant cause of chronic pain low in the back. Herniation and rupture of a disk is an advanced stage of degeneration and is associated with the syndrome of compression of a nerve root. The process of degeneration of the nucleus pulposus and annulus fibrosus is a prerequisite to herniation. Whatever role trauma may play, it is only an accessory one. The syndrome of chronic pain low in the back is due to a weakened lumbar or lumbosacral joint. The syndrome of radiating pain in sciatic distribution is due to compression of a nerve root. These two syndromes are separate entities. They are due to different aspects of the same pathologic process and hence may exist independently or combined. Treatment of the degenerating disk consists in removal of the pathologic tissue.

Peripheral Nerve Injuries Recent Progress in Treatment. T. B. Mouat.

Brit. M. J. **4486**: (Dec. 28) 1946.

The importance of peripheral nerve injuries in modern warfare is shown by the fact that Spurling and Woodhall estimate that there were 25,000 peripheral nerve injuries in the second world war and that they formed 10.5 per cent of battle casualties. There are no fewer than 7,000 end-to-end sutures in the U. S. Registry of Peripheral Nerve Injuries, which was established in November, 1944, to follow up these injuries and assess at regular intervals the results of treatment.

While the final results will not be available for some years, the preliminary reports of surgeons in both American and British neurosurgic teams and centers are of great value and convey information which must influence the future treatment of this type of injury. Holmes and Young, Sanders and other workers showed that the poor results after delayed secondary suture were due to shrinkage of the neurilemma tubes in the peripheral segment, which delayed maturation of the down-growing axonal fibers; and Gutman and Young found that with delay there is progressive

atrophy in the muscle fibers and end-plates, so that the new fibers returning down the tubes are, after some months, unable to re-enter the old nerve plates. The resulting pattern of innervation is then far from normal, and many muscle fibers never recover at all.

Throughout all stages of the treatment of peripheral nerve injuries it is of great importance to remember that denervation is associated with trophic changes which affect all the structures of the limb, including the joints; and though splinting is necessary in their treatment and after-treatment to relax the paralyzed muscles and to safeguard the nerve repair, the splints must be removed frequently to permit guarded exercise to preserve joint mobility and electrical stimulation of the paralyzed muscles, as the one and only criterion of success is restoration of function, which is so quickly lost and so difficult to regain.

The reasons are given why delayed secondary suture of peripheral nerve lesions is likely to prove unsuccessful. The preliminary results of surgical treatment during the second world war; which are now becoming available, furnish strong evidence in favor of early secondary as opposed to primary nerve suture. Recent work on nerve grafts is considered.

Artificial Sunlight Treatment the Proper Perspective. L. Schmidt, and P. P. H. Schmidt.

Brit. J. Phys. Med. 9:175 (Nov.-Dec.) 1946.

The craving of mankind for sunlight is probably as old as the human race itself.

During the recent war many progressive employers installed ultraviolet lamps in their works for the prophylactic treatment of their employees. The effectiveness of such treatment has been questioned recently by Colebrook on the basis of "controlled experiments." The general principles underlying the correct application of "artificial sunlight" for preventive purposes are outlined.

The report may be criticized on three main grounds.

The whole report is based on statistical findings only. Statistics have certainly their own place in throwing light on medical problems, but this place is a rather limited one. The human body is, after all, not a cog in the wheel of a counting machine, but a highly sensitive and complex organism, in which complicated physiologic, biochemical and biologic reactions take place incessantly.

Although Colebrook readily admits the outstandingly favorable subjective influence of the irradiation, she declines to allow that it may have any "objective" effect at all. Subjective and objective effects are, from a medical point of view, a single entity. The feeling of subjective well-being in this case is produced by objective biochemical and biologic changes. Among objective results which might have been studied, that of the effect on output is not dealt with, neither has Colebrook included hematologic and biochemical examinations, which would have come under the heading of "scientifically controlled experiments." Colebrook also assumes throughout that only the shorter ultraviolet rays are of biological or therapeutic importance.

In the technical arrangement of her trials at South Kirkby Colliery, Solebrook allowed the ultraviolet lamps to be installed "in the pithead bath between the showers and the clean locker room." The air in this space was bound to have an abnormally high moisture content, which would cause absorption of ultraviolet rays. Furthermore, the equipment of her "solarium" consisted only of high pressure mercury vapor arc lamps. Attention is drawn to the fact that these generators produce rays the composition of which is not at all the same as that of the rays contained in natural sunlight. To label such radiation "artificial sunlight" is a misnomer. Observations related to a single type of lamp cannot apply to actinotherapy as a whole.

The Place of Physical Medicine in General Practice. Walter J. Zeiter.

Ohio State M. J. 43:42 (Jan.) 1947.

External heat, applied generally and locally, is of value in treating a large variety of conditions. In rheumatic diseases the common triad of heat, massage and exercise is of great benefit to the patient. The application of heat is more extensive and varied in this class of diseases than in any other. The thermal effect may be obtained by the use of hot water, whirlpool bath, infrared radiation, paraffin or diathermy.

The whirlpool bath is a hydrokinetic measure in which water at a temperature between 110 and 115 F. is kept in contsant agitation within a container in which an arm or a leg is immersed. In addition to marked dilatation of the peripheral blood vessels produced by heat, the whirling water also has an effect of gentle massage, which tends to relieve pain and relax muscles in the immersed extremity. The duration of treatment is usually thirty minutes.

Massage of an arthritic joint is usually directed to the muscles above and below the joint. In acute involvement, direct massage may produce trauma and increase symptoms.

Exercise has been estimated to increase the flow of blood through muscles during activity twenty or more times as great as the flow during rest.

Diathermy is an aid in the relief of pain, tenderness and spasm of muscle and in the promotion of the absorptoin of the calcareous deposits in bursitis. In many cases it eliminates the former routine of operating and irrigating the bursa. During the acute inflammatory stage, diathermy should be used at low intensity.

Osteoarthritis of the knees frequently causes disability particularly in obese patients. Application of diathermy or infrared radiation followed by massage, exercises, added rest and the support of an elastic bandage to the involved joint is effective in rehabilitating many of these patients.

Fibrositis involving the lower area of the back is frequently encountered. Before the massage is given, it is well to apply local heat such as diathermy or infrared radiation. The condition may

become aggravated at the beginning of treatment. However, if treatment is continued over a sufficiently long period, pain, tenderness and muscle spasm are usually relieved with disappearance of the nodules.

Physical rehabilitation and reconditioning have become an integral part of the medical programs of practically all Army and Navy hospitals. According to a recent report, "Physical therapy, occupational therapy, physical training and educational and recreational programs are being coordinated in a manner which is completely revolutionizing the convalescent routines for the sick and disabled.

Physiotherapy in an Accident Service. Max Page.

Proc. Roy. Soc. Med. 40:15 (Nov.) 1946.

Departments of physical therapy tend to become overloaded with a mass of human material. Unless regular and rigorous checks are imposed a certain number of patients continue under treatment for months with little benefit to themselves and to the prejudice of the more deserving. It is in the main department, so often the dumping ground filled by various overworked clinicians, that this state of affairs is most in evidence, but similar overcrowding may affect the accident service if certain precautions are not taken. Overloading can be avoided or reduced if the needs of each individual case for physical therapy are carefully estimated.

During the war rehabilitation centers have fully proved their value in the management of bulk casualties. The author is not sure of the degree to which they can be usefully employed in normal civil life. He thinks that in a well-established accident clinic most cases of injury can be seen through to full recovery by the team primarily responsible for their treatment. "Passing the buck," however, is always popular and sometimes it benefits the patient. Certainly the final tuning up after major injuries is best conducted in fair-sized classes.

Rehabilitation After Injuries to the Spinal Cord and Cauda Equina. Ludwig Guttmann.

Brit. J. Phys. Med. 9:162 (Nov.-Dec.) 1946.

Passive movements of the paralyzed limbs are given in conjunction with exercises for the normal parts of the body.

The combined operation of certain muscle groups will greatly improve the balance and mobility of the trunk. Strong action of the muscles will help to shift the psychomotor capabilities in the paraplegic from the paralyzed distal parts to the upper parts of the body, because it makes the activity of the normal upper limbs more effective, owing to the increased fixation of the trunk.

The combined operation of these muscle groups will restore the capacity of the paraplegic to walk between parallel bars or on crutches, by means of pelvic tilting, or by promoting swinging movements of the trunk. To keep the balance in these cases, it is necessary to fix the knees with light bivalved appliances and splints (and later with calipers), keeping the feet at the correct angle by means of simple toe-springs; thus the paralyzed legs are being used like stilts.

The training of the abdominal muscles is of great importance also for the restoration of bladder function and the re-education of the bladder.

Auto-assisted movements with the help of suspension in slings are used and exercises against resistance by means of pulleys and weights are employed.

When the muscle power in the normal parts and the balance of the body have improved sufficiently, standing and walking exercises are begun between parallel bars or in walking chairs, followed by walking on arm and elbow crutches. The exercises are carried out first in the ward, in order to encourage other patients who are not so far advanced. They are continued later in the department of physical therapy and in the long corridors of the hospital, the time and distance of walking being gradually increased. In certain cases, rhythmic walking to music has been included in these exercises and has proved to be beneficial. Naturally, the walking capability of a paraplegic, especially with a cord lesion above Th. 10 segment, will always be limited, but patients with lesions below that level, for instance, Th. 12, with complete paralysis of both lower limbs and sensory loss below Th. 12/L.1, have succeeded, with training, in walking 250 yards in 13½-16 minutes, on arm crutches.

Games are important in the physical and psychologic readjustment of paraplegics.

Still's Disease Successfully Treated with Prostigmine. Report of Case. Marjorie Rittwagen.

Arch. Pediat. 63:630 (Dec.) 1946.

Forty-nine years have passed since Still's famed description of this disease but, though much discussion has taken place in the interim, Still's disease continues to present the interesting dilemma of a malady of questionable entity, unknown etiology, difficult early diagnosis, uncertain prognosis and indefinite treatment. Still described it as a "chronic progressive enlargement of the joints associated with general enlargement of the glands and spleen." He considered it a definite disease entity and this view has been upheld by the French workers in the field. These investigators question a possible infectious basis of the disease and suggest, instead, that it may be due to disturbed parathyroid activity, either by itself or in conjunction with general endocrine or autonomic nervous system inbalance. The English, on the other hand, think of Still's disease as merely a juvenile rheumatoid arthritis which, like all infections, runs a stormier course in the child than in the adult. In a third group are those workers who consider Still's disease a special clinical type of rheumatoid arthritis, generally encountered at an early age. According to the author, in the case presented, intramuscular and oral prostigmine proved effective in halting the progression of Still's disease in an eleven-year-old colored

girl where other treatment had failed (three ampules, prostigmine methyl sulfate, 1-2,000, intramuscularly; and 15 mgm. prostigmine bromide orally a day).

The types of therapy given adequate trial in the year preceding prostigmine treatment included the following: salicylates both orally and by Coburn method; sulfathiazole and sulfadiazine; penicillin; and massive vitamin D. All therapy had been given in conjunction with splinting, bed rest, maintenance of good nutrition, medication for the relief of pain, physical therapy and blood transfusions. The response to prostigmine was immediate. The relief of spasm relieved the pain and motion soon returned. The constitutional symptoms cleared up later.

All joints returned to full and painless motion except those already irreversably deformed before prostigmine treatment was started. Here orthopedic surgery had to be performed. It is felt that these joints would have been spared as well had prostigmine therapy been instituted before contractures developed.

Local Use of Ice After Orthopedic Procedures. H. J. Schaubel.

Am. J. Surg. **72**:711 (Nov.) 1946.

Following surgery or manipulation Schaubel used ice caps on 345 of 824 patients; ice was not used on the remaining 479 patients. Immediately postoperatively the cloth-covered ice bags are applied to the plaster or soft bandage over the operative site. The ice caps are refilled every four hours and are used for forty-eight hours postoperatively. The accumulated air in the ice caps should be released at hourly intervals to allow them to hug the cast snugly. Schaubel found that in the patients in whom ice was used locally fewer casts were split; the temperature, pulse rate and respiratory rate were lower; white blood cell counts were nearer normal; postoperative complications were fewer, and the amount of narcotic needed was reduced. Subjectively, the patients who have ice applied locally fare better in all respects than the patients who have no ice application.

Rest Versus Activity in the Treatment of a Fracture. George Perkins.

Lancet **6437**: (Jan. 11) 1947.

The advantages of encouraging activity of the limb are that rehabilitation can proceed hand in hand with bone repair, and that the harmful effects of splintage are minimized.

All joints not immobilized by splintage should be moved actively by the patient. Since movement is so desirable, the splint should be shortened to its minimum so as to free as many joints as possible.

Activity of muscle is beneficial because it promotes a normal circulation in the limb; it preserves the extensibility of the muscles and so avoids joint stiffness, and it stimulates the formation of callus.

The Goal of Rehabilitation. Howard A. Rusk.

M. Ann. District of Columbia **16**:20 (Jan.) 1947.

Experience with physically and emotionally wounded soldiers has given us new knowledge and new tools in rehabilitation, the third phase of medical care. It has taught us that we must deal with the influence of disease on the individual in terms of its economic, vocational, social and personal effects. It has shown us that in our search for new drugs, diagnostic procedures, surgical technics and laboratory methods, we must not overlook the extra-physical results of illness, the changes it creates in the mind and habits of the patient as well as his body. It has laid the basis for a new medical specialty which is adequately described by an old medical term "orthergasia," which literally means conditioning for normal function and adjustment, the goal of rehabilitation.

Saltant Production by Wavelengths of Visible and Long Ultraviolet Monochromatic Irradiation, and a Comparison with Saltants Produced by Short Wavelengths of Monochromatic Ultraviolet Irradiation in the Fungus Chaetomium Globosum. Joan Munro Ford.

J. Gen. Physiol. **30**:211 (Jan. 20) 1947.

Saltants have been produced by longer wavelengths of ultraviolet monochromatic radiation than has previously been reported. Further experiments have shown that they are also produced by visible radiation. The wavelength 365 mμ was tested by McAulay, who concluded that its effectiveness in producing saltants was very small or perhaps zero. Experiments described in this paper were made at the long wavelengths 365 mμ, an ultraviolet line, and 404 mμ, a violet wavelength, which has not been tested previously. Saltants produced by the wavelengths 365 mμ and 404 mμ have been compared with those produced by irradiation of the spores at short ultraviolet wavelengths, 265 mμ and 280 mμ.

There are two features of significance which stand out from others in this work on the production of saltants by monochromatic ultraviolet and visible wavelengths. The first feature is the production of saltants by the long ultraviolet wavelength 365 mμ and by the visible violet wavelength, 404 mμ. Many of these saltants look similar to those produced by short ultraviolet monochromatic wavelengths.

The ratio of percentage irradiated and unirradiated spores germinating declines with increasing long wavelengths. If the ratio does not drop too much at visible wavelengths longer than 404 mμ, i. e., if the spores are not killed due to length of exposure, saltants may be produced right through the visible spectrum. The dose required for maximum saltant production by 404 mμ is about 9,000 times that required by 280 mμ. So, with even longer wavelengths of visible light, the dose may go up to 100,000 times that required by 280 mμ.

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